RAILROAD GAZETTE

FRIDAY, APRIL 3, 1903.

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Contributions

Reeve's "Thermodynamics of Heat Engines."

Worcester, Mass., March 25, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The criticism of my views upon thermodynamics which forms a part of a review of my text-book* on that subject appearing in *The Engineer* (London) for March 6, is almost wholly one of negation. The reviewer denies the unchangeableness of mass, the existence of potential energy, and the reality of entropy. To views such as these, embodying no constructive position, no concrete reply can be made. The only thing to oppose to it is a positive constructive philosopy of mass, motion, position and energy in entirety. This I have done, in so far as the limits of a single chapter of an undergraduate text-book permits it, in my book. This I am also doing, in so far as a letter to a journal may include it, in a current communication to *The Engineer*. As to the nature of entropy, nothing has been said nor gainsaid in the discussion of my book, public or private, up to date.

A steam engine piston is moved by steam heat. Heat, as all are agreed, is motion. Modern mechanics know of but one thing which can possess motion and which can do work in giving up that motion, and that is mass. But an analysis of the details of the phenomenon of propulsion by heat shows that the mass which is bombarding the piston into retreat cannot be taken to be identical with the total mass of the steam-body in action; it is a portion only of that total mass. The argument, as I follow it, identifies that active portion of the total mass as the entropy of the body.

The adiabatic process, the spontaneous drop in temperature at constant entropy of isolated heat, is a mysterious and useless idea so long as entropy remains a purely mathematical abstraction. When explained by the physical definition of entropy as mass it becomes the simple process of loss of velocity at constant mass by the heat particles engaged in giving up their energy to the piston. They bombard and propel the piston exactly as a rear-end collision bombards and propels the forward caboose through several cars ahead, while the bombarding locomotive is brought to rest. With an argument such as this, more real thermodynamics can be taught in an hour, with the aid of an actual steam engine but without calculus, analytics, Greek letters or co-ordinate diagrams, than can be taught in a year by reliance upon the latter alone.

The simple argument stated above has not been controverted, nor even really touched upon. No better nor truer explanation has been proposed. My position has been merely denied, solely upon the grounds that to make anything useful or sensible of entropy is impossible—a platform scarcely worthy of serious attention.

A matter which is worthy of attention, however, in the name of engineering education, is the editorial appearing in connection with these topics in the last issue of the *Engineering News* (March 19, page 31). This editorial takes the position that "the engineering school should have just two great purposes in view: To teach engineering and to educate men. We [the editors] fail to see how some of the ultra-refinements in mathematics which are forced on students at some of the schools can conduce to either of these ends." In support of this position it quotes, from "one of our ablest engineering educators," as follows: "Mathematics too often beclouds the brain whose tool it is." With this entire attitude I heartily concur. I have ever upheld it with all the earnestness at my command.

Technical educators undertake three lines of work: (1) To train the mind; (2) to bring out the man; (3) last and least, to equip the graduate with mere tools for professional work. Intellectual training consists in an opening of the mind's eye, in teaching the pupil to see the invisible, to see harmony, and law and order, and a firm clear pathway to accomplishment where the ignorant see only darkness, chaos, blind groping in impenetrable confusion, vain hope and ultimate defeat. Every single step of human progress, past and present, has differentiated the men who see and know and believe from those who doubt and fail, between those who have aided and those who have hindered the painful, inevitable, invaluable progress of the race.

Moral education consists chiefly in the development of breadth and charity of view. The really educated man, be he engineer or doctor of divinity, sees in each new man and movement which he meets a fund of possibility for good which may be of worth to him. Where the untaught despise and cast aside he will tolerate, cherish, apprehend and utilize.

It is true, as Mr. Baker holds, that these objects are not to be gained in education by the too great use of mathematics in applied science. It is true that they are fostered only by continued inculcation of a perception of the reality, the unity and the absoluteness of natural law. Is it also true that Mr. Baker's, or Prof. Perry's, attitude toward the present effort to eliminate mathematical abstractions from the study of thermodynamics and to reduce it to a basis of common sense properly upholds those principles? Do they really believe that 20 years from now they will care to repeat their recent statements? Will they then be proud of having defended the intricate, unmeaning hash of approximate details, of inconsistent principles, of useless and confusing mathematical abstractions which now passes in many places, under the name of thermodynamics, for the harmony of natural law? Be entropy what it may, the simplest problem in the thermodynamics of steam cannot be solved without its use. Its perfectly free discussion ought to have a value as wide as the use of the steam engine.

In short, have we not heard enough from those who have to preface their remarks with the statement that they have nothing to say? There are many able men who are in sympathy with and contribute to the construction of the new thermodynamics. Intelligent, constructive criticism of definitions from them would be invaluable to the entire steam engineering profession.

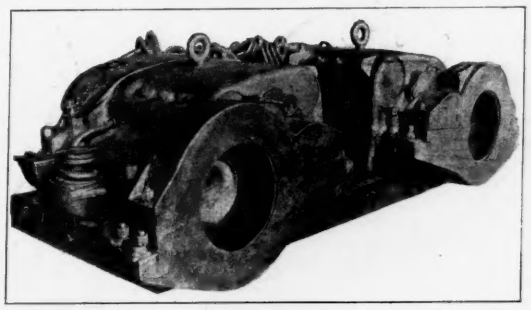
S. A. R.

*A review of Prof. Reeve's book, "The Thermodynamics of Heat Engines," appeared in the *Railroad Gazette*, Feb. 20, 1903.

Westinghouse Motors for the New York Subway.

The motor equipment contract for the cars of the Interborough Rapid Transit Company was divided between the Westinghouse Electric & Manufacturing Co. and the General Electric Company, as mentioned in these columns some time ago.

The subway company will have two classes of train service. The first will consist of five-car local trains, composed of three motor cars and two trailers making an average speed of approximately 16 miles an hour. The second will be eight-car express trains, comprising five motor cars and three trailers, making an average speed of 25 miles or more an hour. The same motors and gearing will be used for both classes of service. Each motor car will be equipped with two motors.



Westinghouse Motors for the New York Subway.

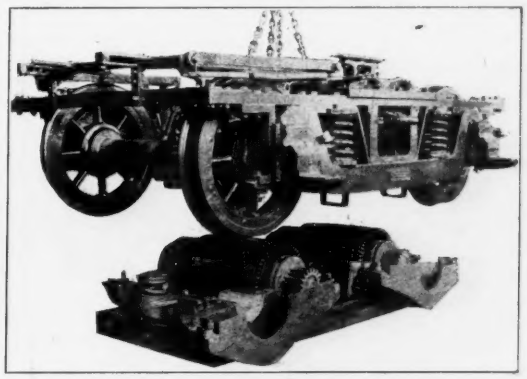
The motors to be supplied by the Westinghouse Electric & Manufacturing Co. were designed especially for this purpose, and were made to fit the particular conditions and requirements involved. One of these requirements, and perhaps the most difficult, made necessary the designing of a motor of large capacity to fit into a limited space. As a result, the present motors are probably of smaller size for their output than any built heretofore.

These motors, known as "No. 86," are of the heavy railroad type, similar in general appearance to the Westinghouse "50-C" motor. They will be supported on the truck by "nose" suspension. The nominal capacity of the motor is 300 amperes at 570 volts, or 200 h.p., for one hour. With this current and voltage a tractive effort of 4,150 lbs. is developed at the periphery of a 33 in. wheel, at a speed of 19 miles an hour. Although designed for an average voltage of 570, the motor will operate satisfactorily with voltages up to 625. It will carry loads up to 700 amperes without injurious sparking.

The motor has a field frame of cast-steel, divided into halves on the line of the centers of armature and axle, and completely surrounding the axle. There are thus no separate axle bearing caps and the number of pieces is consequently reduced to the least number possible for an easily accessible motor. The two halves of the field are held together by eight bolts and by removing these the top half of the field can be readily lifted off and access gained to the interior for inspection, or removal of the coils. When the top field is removed the lower half remains suspended from the axle by stirrups which are permanently attached to the axle bearings.

The four pole pieces are made of laminated steel punchings held between heavy end plates and secured by rivets. Each pole piece is bolted to the field frame by three bolts. These bolts do not pass through the pole pieces, but terminate in a long nut inside, thus affording a smooth unbroken surface and absolutely rigid pole.

The field coils are made of copper strap wound on edge. All four coils are exactly alike in form and in number of turns. The insulation between turns consists of asbestos and mica, held in place by shellac and baked at a high temperature under heavy pressure so that the coil and insulation made a solid mass. The completed coil is sealed in a curved metal case, from which it is insulated by molded mica made like the V-rings of a commutator. This construction gives a coil which is absolutely fireproof, moisture proof, and practically indestructible. Each coil is held in place by the metal case or shell which is securely bolted to the frame.



Method of Removing Motors from Truck.

The armature is 20 in. in diameter and weighs 1,930 lbs. It has a slotted drum and is made of sheet steel punchings assembled on a cast-iron spider. The commutator is also carried on the same spider and the shaft may thus be removed and replaced, should this ever become necessary, without disturbing the armature winding or its connection to the commutator. The winding is the two-circuit type and is ventilated. There are 53 slots and 159 coils, i.e., three coils per slot. Each coil consists of a single turn of copper strap. The three coils which rest in each armature slot are formed and insulated before being put in place. They are placed in the slots without bending or hammering and are carefully insulated from each other and from the core. Each conductor is continuous between commutator bars, thus giving minimum resistance and allowing the most effective insulation on all parts of the conductor.

The coils are held in the slots by wedges of special unshrinakble material which will withstand a high degree of heat without injury. This is a valuable feature and gives a construction which is stronger and safer than the use of bands. It also greatly facilitates the removal and replacing of the armature coils.

The armature insulation consists essentially of mica, which extends between turns at all points. The mica is protected by a sufficient amount of fibrous material to insure against deterioration due to mechanical vibration. This fibrous material is treated with a moisture and oil proof compound. An insulation is thus formed which has fireproof material between turns and between copper and iron at all points, and is therefore capable of withstanding very high temperature without injury.

The commutator is composed of 159 rolled and hard drawn copper bars. These bars have solid necks raised above the surface of the commutator, with milled slots into which the armature bars are tightly soldered. The bars are mounted on a cast-iron spider and held in place by two steel V-shape rings, one of which serves as an oil guard to thoroughly protect the mica from oil or grease. A low voltage between the commutator bars is secured, decreasing the liability of flashing. The bars are insulated from each other by sheets of hard mica so as to wear at the same rate as the copper. The mica separating the bars from the rings is $\frac{1}{16}$ in. thick. The mica ring also separates the bars from the commutator spider. The wearing surface of the commutator is 16⅞ in. in diameter, and 9⅞ in. long. The depth of the bars allows a reduction in diameter of 2 in. for dressing.

The brush holders consist of two cast brass arms, each secured independently to the commutator end of the upper frame casting by a special vulcabeston-headed bolt. The arms and bolts are insulated from the frame by fullerboard and mica bushings. Each arm carries three carbon brushes ⅝ in. x 3 in. in sections. The brushes slide over finished surfaces and each is pressed on the commutator by a spring finger. The tension of these fingers is readily adjustable and the brush holder arm is arranged for radial adjustment to allow for wear of the commutator.

Copper clips are bolted to the carbon, and these clips are connected by flexible shunts to the body of the brush holder, thus relieving the springs from the current. Each brush-holder can be easily removed through the opening above the commutator by loosening a single bolt.

Field and armature leads are of best quality flexible cable, rubber insulated and fireproof. They extend 5 ft. outside the motors and are furnished with detachable connectors. The bottom field lead is brought out of the end of the lower field frame and carried up through a leader on the end of the upper field frame, avoiding the necessity of disconnecting this when opening the motor.

The completed motor will stand an insulation test between winding and motor frame of 4,500 volts alternating momentarily, or a test of 3,000 volts for one minute.

The armature bearings are contained in housings which are securely held between the halves of the field frame, being tongued-and-grooved to the frame and securely doweled. At the pinion end the bearing is 4¼ in. x 10 in., and at the commutator end 4 in. x 7 in. These bearings are provided with drip grooves into which oil is thrown by wiper rings on the shaft. The bearing boxes are phosphor bronze, lined with babbitt metal well grooved for oil. The axle 6½ in. boxes are 12 in. long.

Armature and axle bearings are lubricated by oil fed to the journals by waste, in accordance with standard railroad practice. The oil boxes are formed so that the waste will pack itself against the journals. The oil box covers are lipped and hinged, and fitted with springs that keep the lids tightly closed or hold them open as desired. Drip boxes are provided to catch all waste oil, so that no oil can get into the motor.

The gears are solid, of cast-steel, with cut teeth. The diametral pitch is 2½ per inch, and the face is 5 in. The pinions are forged steel with cut teeth, and are taper bored to fit the shaft and are held in place by a nut and lock washer. The diameter of the shaft at the large end of the taper is 4⅝ in.

The gear case is made of malleable iron planed to a tight joint with a suitable opening at the top having a hinged cover. It is supported at the ends by horns cast on the motor frame and so shaped that they support the gear case without side strain. The motor can be dismantled with ease and without the use of special tools. The total weight of motor, gear, gear case, etc., is about 6,600 lbs.

Criticisms of the Boston & Albany.

In Massachusetts, where complaints of public service quickly find their way to the Legislature, the delays of passenger trains on the Boston & Albany during the past six months have been made a matter of so much public discussion that the Legislature requested the State Railroad Commissioners to investigate and report; and the report has now appeared. A constant note in all the complaints which find their way into the newspapers is the alleged incompetency of the New York Central management as compared with the old régime. The present report finds that delays have been too frequent and that the cars and engines have not been adequate. The lack of good coal for the locomotives was responsible for much of the troublesome delay early in the winter, but it is said that the Boston & Albany appears to have had more trouble from this cause than existed on other roads. Continuing, the Commissioners say:

A specific instance of delay which was brought to our attention ought not to pass without comment. A regular train advertised to start at a given time was held back about an hour and the convenience and necessities of a large number of passengers sacrificed to those of an individual who desired to attach his private car to the train.

This was a violation of first principles in the conduct of a public service. The company does not offer to justify it, but to explain that it was due to misunderstanding of facts. There would seem to be little excuse for a misunderstanding of this kind. The time of starting trains is fixed for the general convenience and the individual has no controlling right in the premises.

The addition to the number of trains, the quickening of the running time, the development of through traffic and the introduction of a modern system of train despatching have all been improvements in furtherance of the public as well as private interests; but the good which might have been realized through these improvements was jeopardized in an attempt to make them without first securing such additions to the rolling stock as would insure successful results.

We understand that 24 new engines and 36 new passenger coaches have already been ordered, some of which have been delivered. This would mean not much, if any, more than the outlay usual to maintain the property.

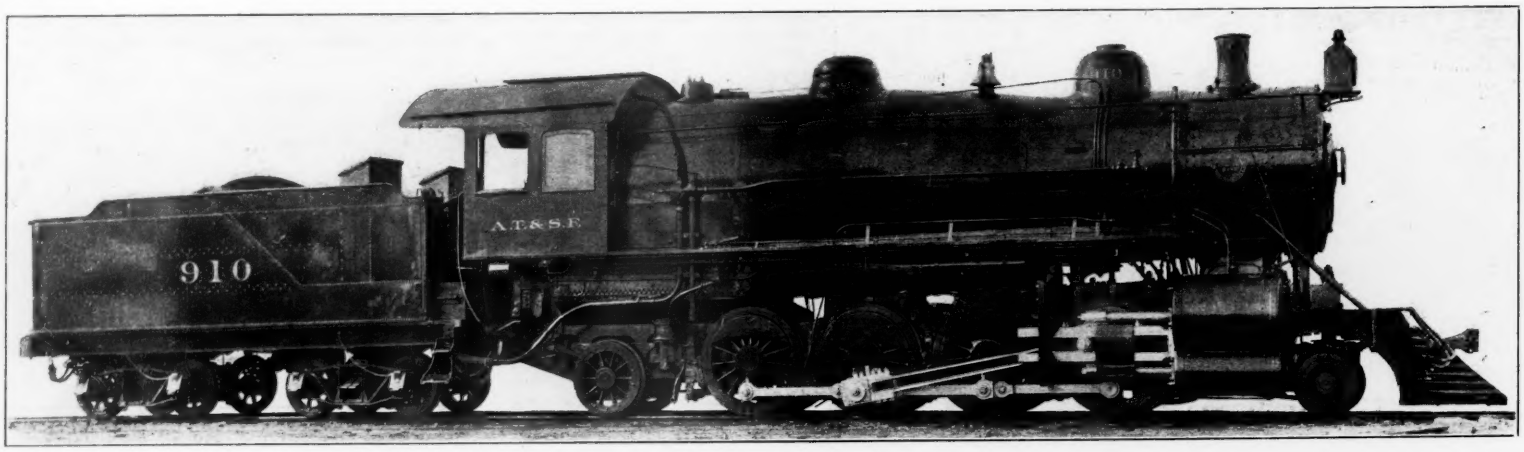
If the equipment delivered to the N. Y. C. & H. R. R. R. Co. under the lease had been of modern and standard type throughout, an expenditure large enough to maintain it would be sufficient. It is not of such character, however, and there is need of a further substantial improvement in both cars and locomotives.

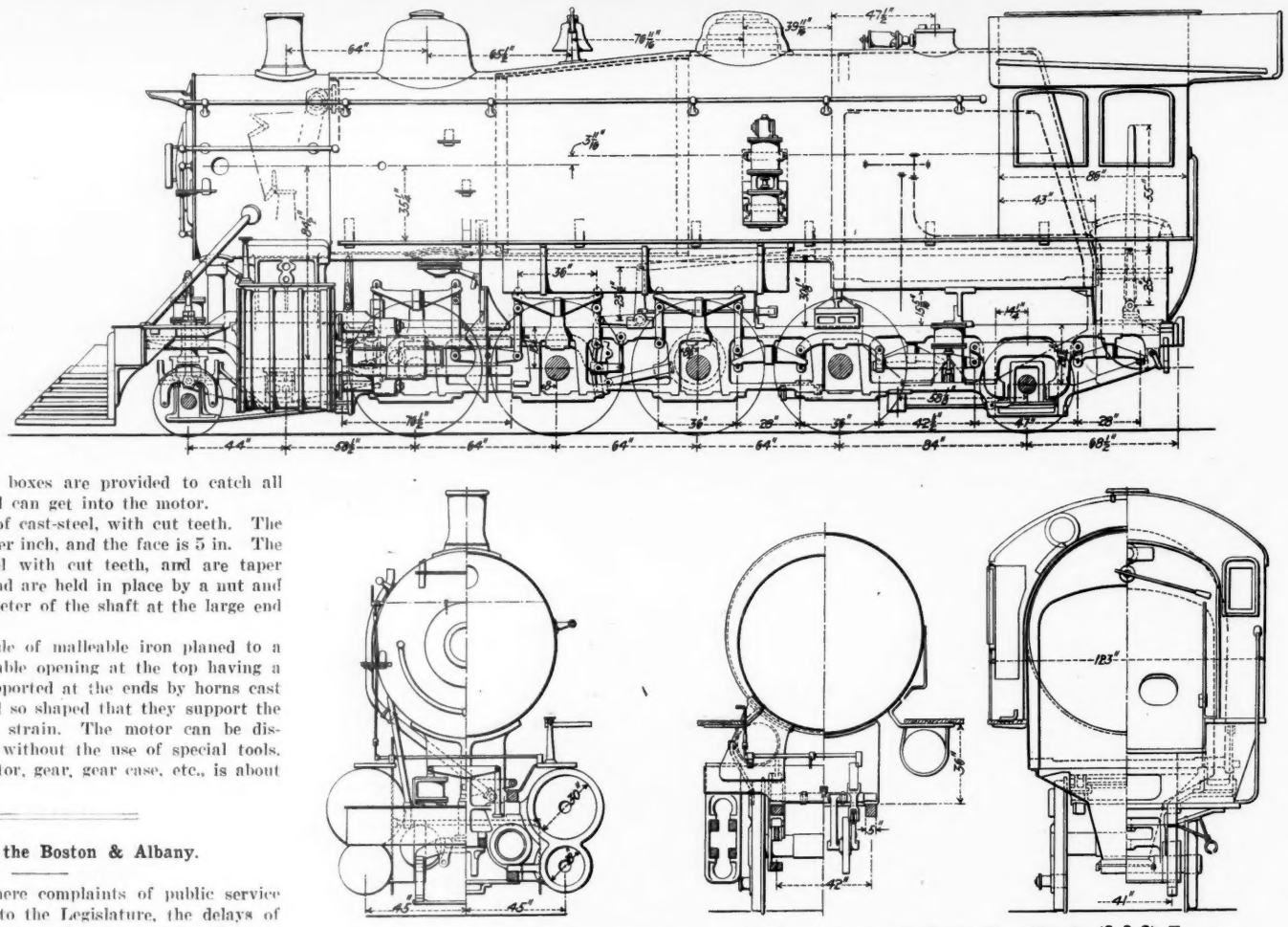
As we believe that the company appreciates this need and will comply with the recommendations of the board, there would seem to be no call for legislation.

Press despatches say that the principal railroads in Michigan have refused to pay the taxes which are due to the State on the basis of the recent ad valorem law, and that 24 companies have filed bills in the United States Circuit Court against the Auditor-General to restrain the collection of taxes.

Mikado (2-8-2) Compounds for the Atchison.

The Baldwin Locomotive Works is building 15 Vauclain compound freight locomotives for the Atchison, Topeka & Santa Fe. The engines are to be used on the Raton mountain division, the maximum grade being about 185 ft. per mile. It will be seen from the illustrations that the wheel arrangement is the "Mikado" or 2-8-2 type. The total weight is 260,000 lbs. with 200,000 lbs. on the drivers. The weight on drivers can be increased, however, at starting by means of the traction increaser which is provided. This latter device is the invention of Mr. John Player, and temporarily shifts part of the weight resting on the front and rear trucks to the driving wheels. This device was described in detail in the *Railroad Gazette* Jan. 17, 1902. Its operation is controlled by the position of the reverse lever so that when the speed increases and the engine is "hooked up" the weight on drivers and trucks returns to normal. The engine is the heaviest of this type ever built, the nearest approach being one built for the Mexican Central in 1897 by the Brooks Locomotive Works and weighing 193,450 lbs., with 145,200 lbs. on the drivers.





Vauclain Compound Locomotive for the Atchison, Topeka & Santa Fe—Mikado (2-8-2) Type.

It is interesting to compare these new locomotives with the heavy tandem compound Decapods* (ten drivers) built for this same road by the Baldwin Locomotive Works, in 1902. The following table gives the principal dimensions of both engines.

	Mikado.	Decapod.
Total weight, lbs.	260,000	267,800
Weight on drivers, lbs.	200,000	237,800
Heating surface, sq. ft.	5,366	5,390
Grate area, sq. ft.	58.5	58.5
Cylinders, in.	18 and 30 x 32	19 and 32 x 32
Diameter of drivers, in.	57	57

It will be seen that the Decapods are but 7,800 lbs. heavier than the Mikados, the former being, by the way, the heaviest and most powerful locomotives in the world. There is 37,800 lbs. difference in the normal weight on

*See the *Railroad Gazette*, May 30, 1902.

drivers, but, as before stated, the traction increaser reduces this difference at starting. The boilers of both classes of engines are practically the same in design and in total heating surface, and we refer the reader to the description of the Decapods for that detail. The maximum tractive effort of the new locomotives is 55,600 lbs., while that of the Decapods is 62,000 lbs.

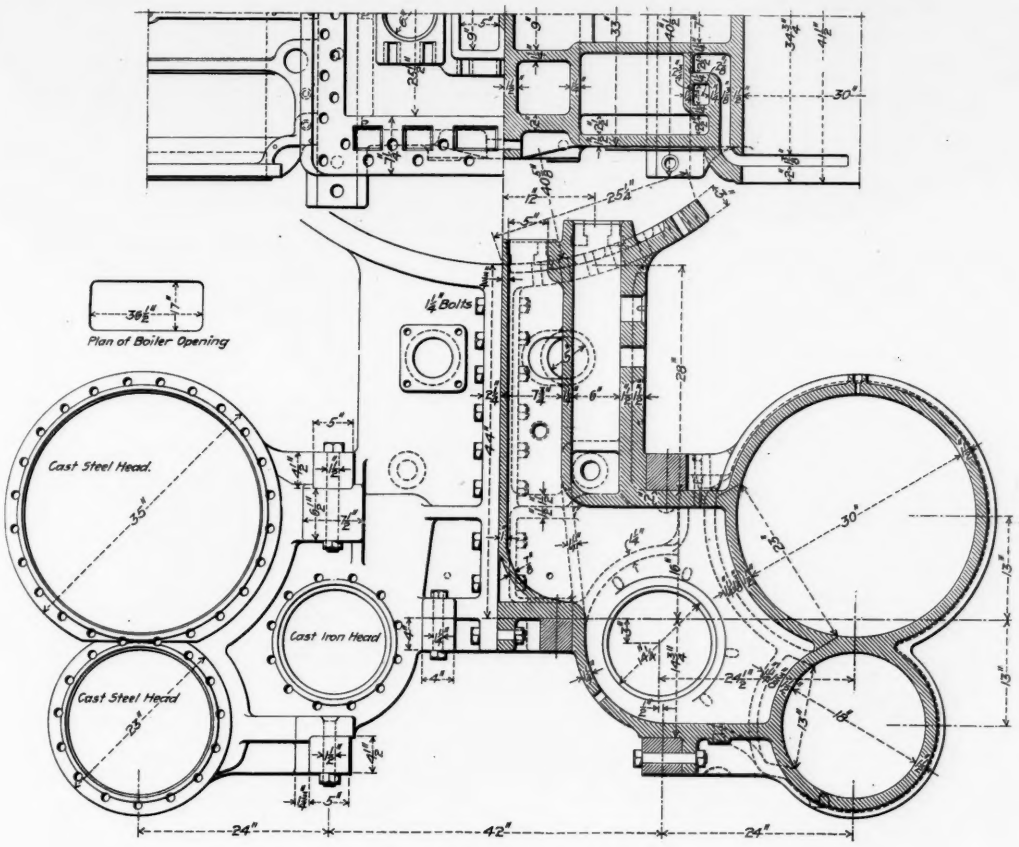
Some of the typical ratios follow:

Wt. on drivers divided by maximum tractive effort	3.6
Wt. on drivers divided by total heating surface	37.2
Heating surface divided by grate area	91.7
Tube surface divided by fire-box heating surface	24.5
Heating surface divided by low pressure cylinder volume (one side)	422
Grate area divided by low pressure cylinder volume (one side)	4.61
Ratio of cylinder volumes	2.77

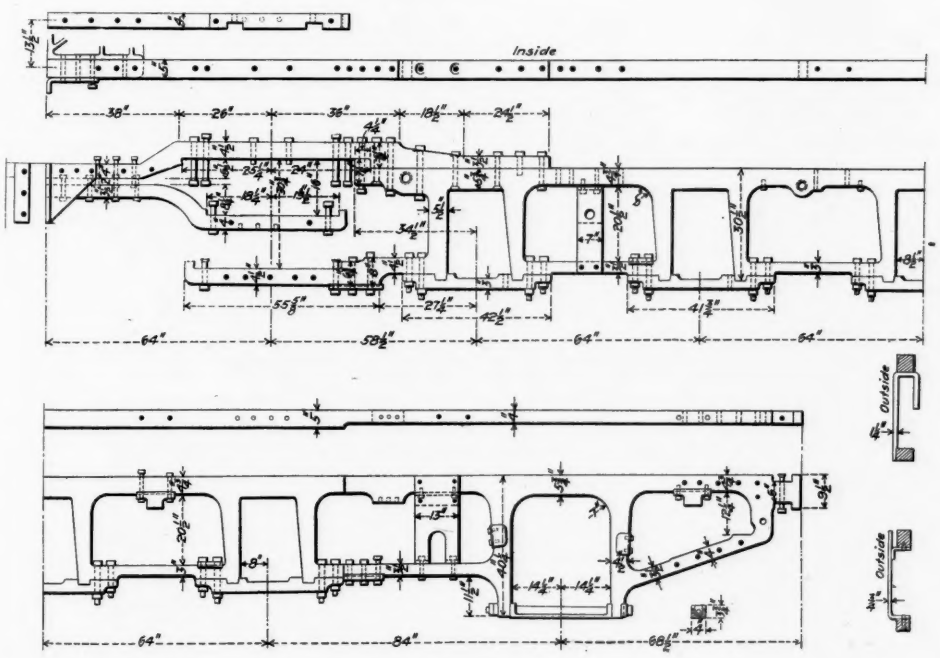
The steaming capacity of these new engines is evidently high as indicated by the ratio between the weight on drivers and total heating surface, which is but 37.2 (a fair value for a passenger locomotive).

A general description follows:

Weight on drivers	200,000 lbs.
Weight on front truck	26,000 lbs.
Weight on rear truck	34,000 lbs.
Weight, total	260,000 lbs.
General Dimensions.	
Wheel base, total, of engine	31 ft. 6½ in.
Wheel base, driving	16 ft.
Wheel base, total, engine and tender	59 ft. 5¼ in.
Heating surface, fire-box	210.3 sq. ft.
Heating surface, tubes	5155.8 sq. ft.
Heating surface, total	5366.1 sq. ft.
Grate area	58.5 sq. ft.
Wheels and Journals.	
Drivers, number	8
Drivers, diameter	57 in.
Truck wheels, diameter	29¼ in.
Trailing wheels, diameter	40 in.
Journals, driving axle	11 in. x 12 in.
Journals, truck	6½ in. x 10½ in.
Journals, trailing	7½ x 12 in.
Cylinders.	
Cylinders, diameter	18 in. and 30 in.
Piston, stroke	32 in.
Valve	Balanced piston
Boiler.	
Type of	Wagon top
Working pressure	225 lbs.
Diameter	78¾ in.
Staying	Radial
Fire-box.	
Length	108 in.
Width	78 in.
Depth, front	80 in.
Depth, back	78 in.
Material	Steel
Thickness of sheets: Sides ⅜ in., back ⅝ in., crown ⅜ in., tube 9/16 in.	
Water space	Front 4½ in., sides 4 in., back 4 in.
Tubes.	
Number	463
Diameter	2¼ in.
Length	19 ft.
Tender.	
Type	8-wheel
Tank capacity	7,000 gal.
Tender wheels, diameter	34¼ in.
Journals	5½ in. x 10 in.



Section through Cylinders and Saddle.



Frame.

The Development of a Strike.

A petition was recently received from the employees of a shop in an interior town asking a wage advance of four cents per hour, the limitation of apprentices and the abolition of piece work. The head of the motive power department in a long conference with a committee of the employees stated that there would be an increase in wages, but explained that an advance to the full extent desired could not be granted under the existing competitive conditions, and in response to the request that the number of apprentices be limited—confessedly that the supply of workmen by kept below the demand—he pointed out that the majority of the apprentices were sons of the mechanics employed in the shops, that the work of the company could not be done without an increasing supply of mechanics, and that it was preferable that they be trained in the company's methods in its own shops. He demonstrated that under the piece-work system not only did the company pay for exactly what it obtained and the men receive pay for exactly what they did, but that competent and industrious employees made more than under day wages. Toward midnight the meeting adjourned, the committee stating that it would recommend to the employees that they change their position. The motive power chief heard nothing further from the matter for nearly a month, and supposed the incident to be closed except that preparations were being made for the promised advance in wages at the agreed date. But one morning, while in consultation with one of the company's superintendents in his private office at a terminal station, there swaggered into the room unannounced two men with arrogance and insolence in manner and voice, who stated that they were the business agents of a mechanics' union and came in behalf of the workmen at the shops in the interior town; that they proposed to have the full advance in pay which had been asked; that the apprentices were to be reduced and the piece work abolished; that the officers of the union were to be recognized as the representatives of the shop employees; that if these demands were not acceded to at once the shops would be idle the following Monday, they continued, saying that this was a crusade which would extend to other shops on the system and to other railroads. The superintendent of motive power declined to discuss the matter with them, saying that the affairs of the company and its employees could not be adjusted by those who had no interest at stake, and even if they possessed adequate information regarding the matter were not parties thereto. He telegraphed the shops asking the employees to send a committee of their number and the next day to this committee, in the presence of the two bullies who were posing as the advisers of and mediators in behalf of labor, he repeated the statements of the month before, and again the employees were satisfied and went to their homes. The demagogues followed them, however, continued their agitation, threatened the local master mechanic and finally induced the employees to repudiate their promises and agree to strike. At this juncture, however, the matter was taken in hand by the business men of the town, who insistently placed before the shopmen the utter folly of their position, showing that their wages were good, their employment steady and that an increase in wages had been promised; that they would lose far more by striking and antagonizing the company than by abiding its position. These arguments were conclusive and the strike was averted at the last minute, despite the bad influence of the union. Two adventurers, the "business agents" of a union 150 miles from the scene, had projected themselves into the relations between the company and its employees that by the original conference had been restored to peacefulness and had endeavored to stir up further trouble.

Another instance: After an all-round increase in wages was recently announced by a railroad company the employees in a boiler shop threw down their tools and walked out. No petition or grievance had been received from that shop; there was no intimation that the men expected a greater advance in wages than was given; there had been no mediation or negotiation by committees of the employees or of labor unions. The men simply quit work without provocation or warning. Investigation showed that the trouble had been caused by two or three turbulent and irresponsible spirits, who had succeeded, by use of that threat and cajolery which are a considerable portion of the equipment of the labor agitator, into cowing the conservative into a strike, the pretext finally given being that the wages were not as high as in a large city in the vicinity, where rents and other expenses were higher in vastly greater degree than the difference in wages. When these two men were deported the others contentedly returned to work.

One Trade Union's Idea of Responsibility.

The Amalgamated Society of Railway Servants of India and Burma, "views with alarm" the Taff Vale decision, and complains that the position of trade unions has been entirely changed, at a single sweep. The British Trade Union Acts of 1871 and 1875, seem to offer shelter no longer, but the funds of the unions are liable at any moment to be depleted by the employers of labor. It is further alleged that the employer is permitted to do the specific acts which the workman is debarred from doing, in that he may use persuasion to induce workmen not to join their union, dismiss them if they do belong, blacklist trade unionists, etc., while the law now expressly prohibits workmen from similar acts of persuasion and blacklisting. The obvious fallacy of this view is that "persuasion," as done by trade unions in the prohibited sense, implies a conspiracy to effect breach of contract and the commitment of illegalities directly punishable by law. But the remedy urged by the unions is dangerously suggestive. It seems to them that the laws which are making them so much trouble are sprung from personal bias, better described as class prejudice. The relief, therefore, is to be gained by a change in the personnel of those who make and interpret the laws. The *Railway Times* of Bombay, India, comments with enthusiasm on the proposed fund which the National British Labor Conference has decided to create for the purpose of fighting elections independent of Liberals, Socialists

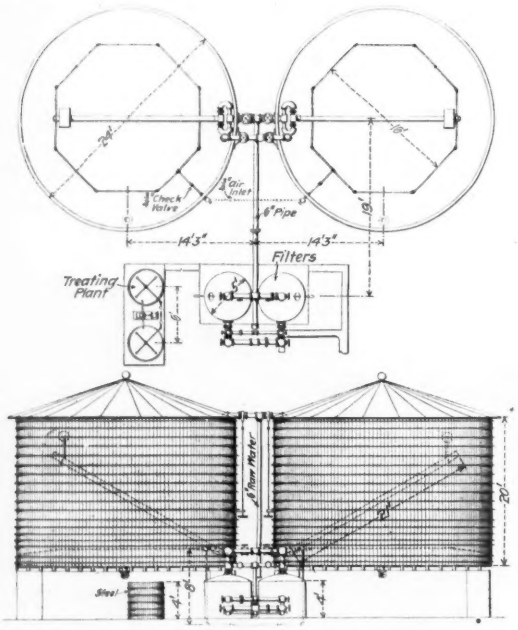
and Conservatives, and from which labor members of Parliament are to be paid an annual salary of £200. It is maintained that this is a movement in the right direction, and is necessary for the "balancing of forces in the legislative assembly of the country which alone can assure to the populace the enactment of those measures which are necessary for their welfare." Regardless of the merits of the case, it looks as if the National Labor Conference had got hold of the working end of their proposition. Let them be well represented in the law-making department of the government and be quite prepared to obey the law.

The Point Where a Strike Ends.

The British National Labor Conference has drafted a bill designed to "legalize the peaceful conduct of trade disputes," and is trying to have it presented before the House of Commons. Picketing and persuasion, without violence, is to be made exempt from the "watching or besetting" clause of the conspiracy Act; agreements by two or more persons to do acts in furtherance of trade disputes shall not be actionable unless the things done would afford ground for action if performed by an individual, and damage suits are not to be brought against trade unions by reason of acts performed by members, unless it can be proved that the members in question acted with the direct sanction of the rules of the union. The *Railway News*, of London, wastes little time in argument on the common fallacies involved in the ideas of peaceful persuasion, and in the proof of direct union sanction for acts committed by strikers, but goes at once to fundamentals. "The striker is legally entitled to deprive his employer of his services, in the hope that the employer may find that those services are indispensable." But the moment the strikers' places are permanently filled, the strike ceases to exist, and a bill which provides for any further "conduct of the dispute" beyond this point, is described by the critic as a bill designed to give immunity to the perpetrators of certain specific crimes, and to take certain specific torts out of the purview of the law. The difference in status of the striker and of the man who has struck is unmistakably plain.

Water Softening Plant For the Buffalo, Rochester & Pittsburgh, Punxsutawney, Pa.

The water in Mahoning Creek is strongly impregnated with iron sulphate and sulphuric acid, due to the drainage from the coal mines, and is unfit for locomotive boilers. About Jan. 1 the Buffalo, Rochester & Pittsburgh contracted with the Pittsburg Filter Manufacturing Company of Pittsburg, for the installation of an intermittent water purification plant of 350,000 gallons daily capacity. The water is lifted about 15 ft. from Mahoning Creek into one of the precipitating tanks, 24 ft. in diameter and 20 ft. high. These tanks have cone shaped bottoms to facilitate drainage.



Water Softening Plant—Buffalo, Rochester & Pittsburgh, Punxsutawney, Pa.

The raw water is treated with cream of lime for the neutralization of sulphuric acid and for the precipitation of iron sulphate. When the tank is filled within 6 in. of the top, a soda ash solution is added to remove any calcium or magnesium sulphates. The water is then violently agitated with compressed air and the chemicals thoroughly mixed with the water.

An average of a number of analyses taken for 10 days last year is as follows:

Sodium chloride	.80	grains per gallon
Calcium sulphate	16.20	" "
Magnesium sulphate	4.76	" "
Iron sulphate	5.97	" "
Silica	.21	" "
Sulphuric acid	10.19	" "
Volatile and organic matter	2.81	" "
Total solids	40.94	

At other seasons of the year the variation is proportionate. If a continuous type of plant had been used, it would need constant attention, for the reason that no machine has ever been built which is automatic for changes in quality of water.

A tank of 65,000 gallons of water is prepared in the usual manner. After the water settles it flows by gravity through an outlet into two filters filled with crushed quartz. The outlet valve is hinged at the bottom of the tank and is operated by a float so that the intake is always 10 in. underneath the water line. It then passes out to the clear water well from whence it is pumped to the roadside tank, on the hillside about 400 ft. from the softening plant. The filters are 5 ft. in diameter and 4 ft. high, and are known as the shallow bed gravity type. Each filter contains 180 strainers of non-corrosive brass with slotted openings one-sixtieth of an inch wide.

The treating plant which supplies the lime and soda to the water consists of two solution tanks 4 ft. in diameter and 4 ft. high. A small steam pump handles the lime and soda solution. The chemicals may be introduced into the tank direct or into the discharge of the raw water pump. The length of time required for precipitation varies from 30 minutes to one and one-half hours, and the clear water basin has a capacity of 6,000 gallons.

Railroad Shops.†

BY WALTER G. BERG, *Chief Engineer, Lehigh Valley.*

III.

Floor Space and Relative Proportions of a Locomotive Repair Shop.—There is no general recognized rule or even comparative data available as to the floor space required for the several sub-departments of a locomotive shop.

The following tables have been prepared from the best information available. They cannot be considered strictly accurate, as the figures are compiled mainly from the original plans and published descriptions. The actual division of the work and sub-departments has no doubt in many cases been changed from the original plans. Where several sub-departments are grouped in one building without solid partitions between them, as when erecting and boiler work are done on the same set of tracks, the actual space occupied by each will fluctuate with the daily demands. In many cases a building marked on the plans as a boiler shop is used for tank shop, flue shop, heavy forging shop, casting shop, etc. In such cases the relative division of the floor space cannot properly serve for comparison, but the aggregate space given for a combination of such departments is valuable.

In using the data presented full value must be given to the fact that in many cases local conditions and individual opinions of designers may have controlled the plan, as also the fact that the facilities frequently cover work for other departments than locomotive repairs. Many of the layouts, especially the older ones, were not planned for the repairs of the heavy and large power. The class of service and engines also naturally influence the facilities required on different roads. In addition, the number of engines concentrating at a given shop is variable.

The shops covered by the tables are grouped as follows:

Group I.—Cross shop, with transfer table at general repair shops, where all departments are served by one transfer table: Oelwein, Ia., Chicago Great Western; Hannibal, Mo., Chicago, Burlington & Quincy; Fond du

†Continued from page 209.

TABLE 1.—LOCOMOTIVE REPAIR SHOPS—SQUARE FEET OF FLOOR SPACE PER ERECTING PIT.

	Year built.	Erecting pits, No.	Erecting shop.	Machine shop.	Total erecting and machine shop.	Boiler shop.	Blacksmith shop.	Total of four main Depts.	Additional Bldgs.	Total all Bldgs.
Group I—										
Oelwein, Ia.	1899	15	1,626	1,760	3,386	626	*508	4,520	1,335	5,855
Hannibal, Mo.	1901	10	1,518	1,610	3,128	673	*867	4,668	1,991	6,659
Fond du Lac, Wis.	1901	15	1,419	1,419	2,838	757	*757	4,352	1,775	6,127
Denver, Colo.	1901	9	1,599	1,482	3,081	799	*798	4,678	842	5,522
Pocatello, Idaho	1902	10	1,688	1,687	3,375	1,950	*1,275	6,600	1,305	7,905
Group II—										
West Albany, N. Y.	Old	42	1,890	1,983	3,873	117	615	4,605	...	...
St. Paul (Omaha R. R.)	Old	15	1,320	1,426	2,746	2,144	720	5,610	1,087	6,697
Chicago (C. & N. W.)	Old	25	1,510	1,904	3,414	1,380	1,280	6,074	3,646	9,720
Jackson, Mich.	Old	30	1,639	1,309	2,948	380	350	3,678	2,122	5,800
Chicago (Ill. Central)	1892	25	1,760	1,760	3,520	800	*2,074	6,394	1,402	7,796
Depew, N. Y.	1892	48	1,517	596	2,113	637	421	3,171	1,005	4,176
Knoxville, Tenn.	1893	16	1,204	902	2,106	756	*1,250	4,112	859	4,971
Baring Cross, Ark.	1901	15	1,560	1,365	2,925	1,800	*1,333	6,058	1,884	7,942
Oak Grove, Pa.	1902	25	2,288	1,294	3,582	3,223	644	7,449	1,228	8,677
St. Paul (Great Northern)	1902	25	1,800	1,800	3,600	2,446	1,520	7,566	3,314	10,880
Group III—										
Reading, Pa.	1901	70	1,480	634	2,114	686	525	3,325	929	4,254
McKees Rocks, Pa.	1902	24	1,598	2,340	3,938	1,145	*650	5,733	733	6,466
Collinwood, O.	1902	24	1,535	2,208	3,743	1,734	*1,400	6,877	1,614	8,491
Group IV—										
Altoona, Pa. (Juniata)	1890	14	1,770	2,764	4,534	2,206	1,748	8,488	2,374	10,862
Concord, N. H.	1897	12	1,779	1,525	3,304	612	500	4,416	1,339	5,755
Du Bois, Pa.	1901	14	1,770	1,618	3,388	1,627	811	5,826	1,836	7,662
Elizabethport, N. J.	1901	20	2,000	1,750	3,750	1,500	*1,200	6,450	1,551	8,001
Omaha, Neb.	1902	18	1,667	1,667	3,334	2,033	*1,220	6,587	2,872	9,459
Topeka, Kan.	1902	24	1,700	1,817	3,517	1,912	*1,667	7,096	1,042	8,138
Montreal, Canada	1902	42	1,739	1,739	3,478	1,386	*1,879	6,743	1,871	8,614

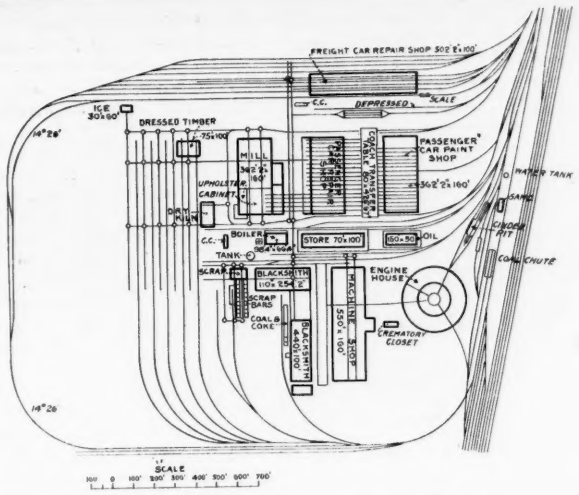
TABLE 2.—LOCOMOTIVE REPAIR SHOPS—RELATIVE SIZE OF BUILDINGS IN PERCENTAGE OF ERECTING SHOP.

	Year built.	Erecting pits, No.	Erecting shop.	Machine shop.	Total erecting and machine shop.	Boiler shop.	Blacksmith shop.	Total of four main Depts.	Additional Bldgs.	Total all Bldgs.
Group I—										
Oelwein, Ia.	1899	15	100.0	108.2	208.2	38.5	*31.2	277.9	82.1	360.0
Hannibal, Mo.	1901	10	100.0	106.1	206.1	44.3	*57.1	307.5	131.2	438.7
Fond du Lac, Wis.	1901	15	100.0	100.0	200.0	53.3	*53.3	306.6	125.2	431.8
Denver, Colo.	1901	9	100.0	92.7	192.7	50.0	*50.0	292.7	52.7	345.4
Pocatello, Idaho	1902	10	100.0	100.0	200.0	115.5	*75.6	391.1	77.4	468.5
Group II—										
West Albany, N. Y.	Old	42	100.0	52.0	152.0	59.1	32.5	243.6	...	...
St. Paul (Omaha R. R.)	Old	15	100.0	108.0	208.0	162.4	54.6	425.0	82.3	507.3
Chicago (C. & N. W.)	Old	25	100.0	126.1	226.1	91.4	84.8	402.3	241.5	643.8
Jackson, Mich.	Old	30	100.0	79.8	179.8	23.2	21.4	224.4	129.5	353.9
Chicago (Ill. Central)	1892	25	100.0	100.0	200.0	45.4	*118.1	363.5	79.7	443.2
Depew, N. Y.	1892	48	100.0	39.3	139.3	42.0	27.8	209.1	66.2	275.3
Knoxville, Tenn.	1893	16	100.0	75.0	175.0	62.8	*103.8	341.6	71.4	413.0
Baring Cross, Ark.	1901	15	100.0	87.5	187.5	115.4	*85.2	388.1	120.7	508.8
Oak Grove, Pa.	1902	25	100.0	56.5	156.5	140.9	28.1	325.5	53.7	379.2
St. Paul (Great Northern)	1902	25	100.0	100.0	200.0	136.0	84.3	420.3	184.1	604.4
Group III—										
Reading, Pa.	1901	70	100.0	42.9	142.9	46.3	35.5	224.7	62.7	287.4
McKees Rocks, Pa.	1902	24	100.0	146.5	246.5	71.7	*40.7	358.9	45.9	404.8
Collinwood, O.	1902	24	100.0	143.8	243.8	112.9	*91.2	447.9	105.2	553.1
Group IV—										
Altoona, Pa. (Juniata)	1890	14	100.0	156.2	256.2	124.6	98.8	479.6	134.1	613.7
Concord, N. H.	1897	12	100.0	85.7	185.7	34.4	28.1	248.2	75.3	323.5
Du Bois, Pa.	1901	14	100.0	91.4	191.4	91.9	45.9	329.2	103.7	432.9
Elizabethport, N. J.	1901	20	100.0	87.5	187.5	75.0	*60.0	322.5	77.5	400.0
Omaha, Neb.	1902	18	100.0	100.0	200.0	122.0	*73.2	395.2	172.3	567.5
Topeka, Kan.	1902	24	100.0	106.9	206.9	112.5	*98.0	417.4	61.3	478.7
Montreal, Canada	1902	42	100.0	100.0	200.0	79.7	*108.0	387.7	107.6	495.3

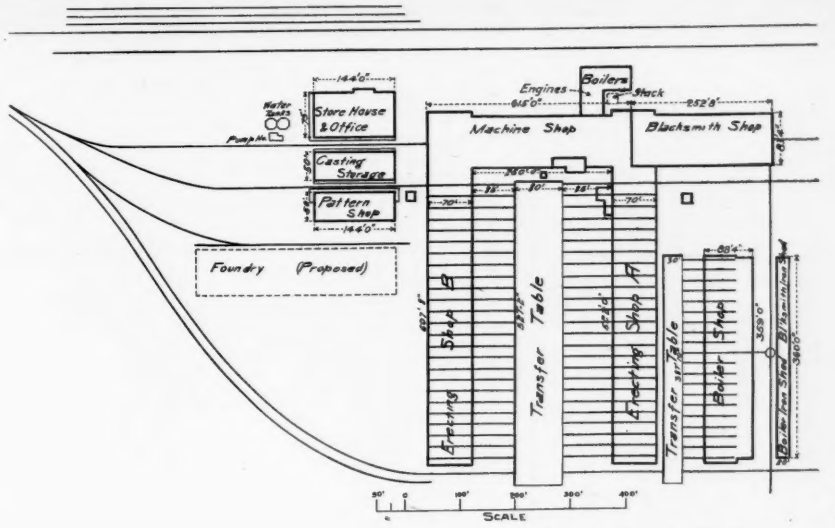
TABLE 3.—LOCOMOTIVE REPAIR SHOPS—RELATIVE SIZE OF THE MAIN DEPARTMENTS.

			Percentage of four departments.					Per cent. of three departments			
	Year built.	Erecting pits. No.	Erecting shop.	Machine shop.	Boiler shop.	Blacksmith shop.	Erecting and machine shops.	Boiler and blacksmith shops.	Erecting shop.	Machine shop.	Erecting and machine shops.	Boiler shop.
Group I—												
Oelwein, Ia.	1899	15	36.0	38.9	13.8	*11.3	74.9	25.1	40.5	43.9	84.4	15.6
Hannibal, Mo.	1901	10	32.5	34.5	14.4	*18.6	67.0	33.0	39.9	42.4	82.3	17.7
Fond du Lac, Wis.	1901	15	32.6	32.6	17.4	*17.4	65.2	34.8	39.5	39.5	79.0	21.0
Denver, Colo.	1901	9	34.1	31.7	17.1	*17.1	65.8	34.2	41.2	38.2	79.4	20.6
Pocatello, Idaho	1902	10	25.6	25.6	29.5	*19.3	51.2	48.8	31.7	31.7	63.4	36.6
Group II—												
West Albany, N. Y.	Old	42	41.1	21.3	24.3	13.3	62.4	37.6	47.3	24.7	72.0	28.0
St. Paul (Omaha R. R.)	Old	15	23.6	25.4	38.2	12.8	49.0	51.0	27.0	29.2	56.2	43.8
Chicago (C. & N. W.)	Old	25	24.9	31.3	22.7	21.1	56.2	43.8	31.5	39.7	71.2	28.8
Jackson, Mich.	Old	30	44.6	35.6	10.3	9.5	80.2	19.8	49.3	39.3	88.6	11.4
Chicago (Ill. Central)	1892	25	27.5	27.5	12.5	*32.5	55.0	45.0	40.8	40.7	81.5	18.5
Depew, N. Y.	1892	48	47.8	18.8	20.1	13.3	66.6	33.4	55.2	21.7	76.9	23.1
Knoxville, Tenn.	1893	16	29.3	21.9	18.4	*30.4	51.2	48.8	42.1	31.5	73.6	26.4
Baring Cross, Ark.	1901	15	25.8	22.5	29.7	*22.0	48.3	51.7	33.0	28.9	61.9	38.1
Oak Grove, Pa.	1902	25	30.7	17.4	43.3	8.6	48.1	51.9	33.6	19.0	52.6	47.4
St. Paul (Great Northern)	1902	25	23.8	23.8	32.3	20.1	47.6	52.4	29.8	29.8	59.6	40.4
Group III—												
Reading, Pa.	1901	70	44.5	19.1	20.6	15.8	63.6	36.4	52.9	22.6	75.5	24.5
McKees Rocks, Pa.	1902	24	27.9	40.8	20.0	*11.3	68.7	31.3	31.5	46.0	77.5	22.5
Collinwood, O.	1902	24	22.3	32.1	25.2	*20.4	54.4	45.6	28.0	40.3	68.3	31.7
Group IV—												
Altoona, Pa. (Juniata)	1890	14	20.8	32.6	26.0	20.6	53.4	46.6	26.3	41.0	67.3	32.7
Concord, N. H.	1897	12	40.3	34.5	13.9	11.3	74.8	25.2	45.4	38.9	84.3	15.7
Du Bois, Pa.	1901	14	30.4	27.7	27.9	14.0	58.1	41.9	35.3	32.3	67.6	32.4
Elizabethport, N. J.	1901	20	31.0	27.1	23.3	*18.6	58.1	41.9	38.1	33.3	71.4	28.6
Omaha, Neb.	1902	18	25.3	25.3	30.8	*18.6	50.6	49.4	31.1	31.1	62.2	37.8
Topeka, Kan.	1902	24	24.0	25.6	26.9	*23.5	49.6	50.4	31.3	33.5	64.8	35.2
Montreal, Canada	1902	42	25.8	25.8	20.6	*27.8	51.6	48.4	35.7	35.7	71.4	28.6

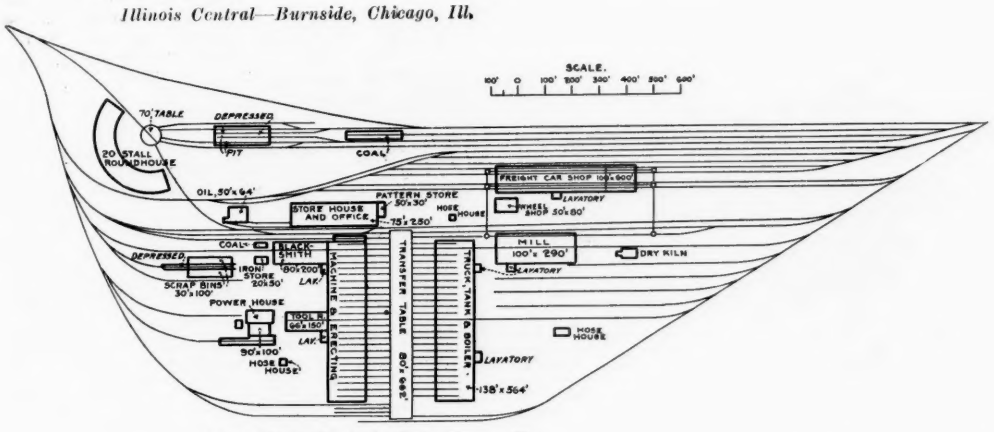
*Blacksmith shop includes work for car department.



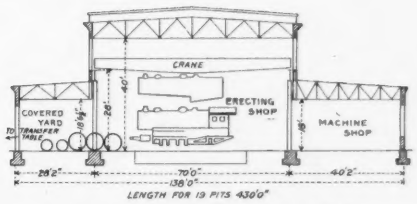
Illinois Central—Burnside, Chicago, Ill.



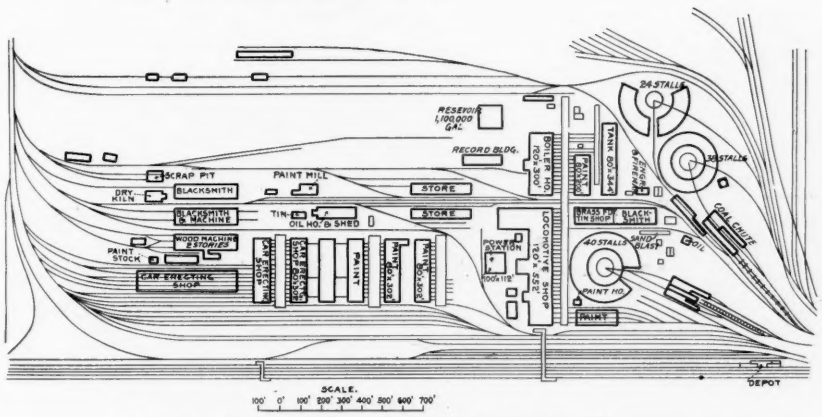
New York Central—Depew, N. Y.



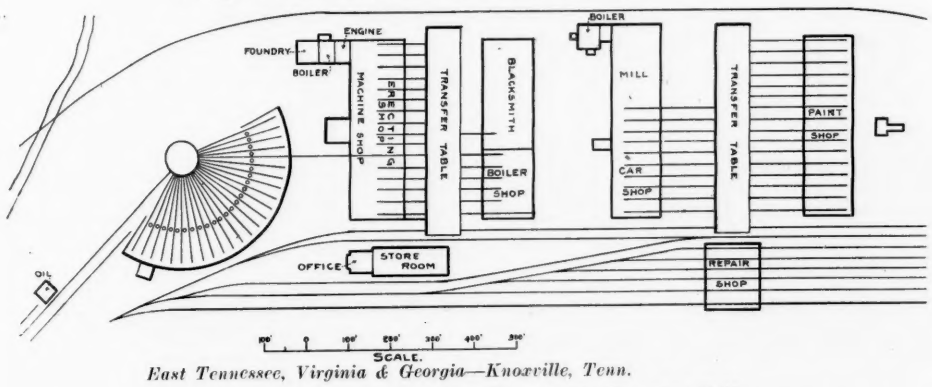
New York Central—Oak Grove, Pa.



Locomotive Shop—N. Y. C., at Oak Grove, Pa.



Chicago & North Western—Kinzie Street, Chicago, Ill.



East Tennessee, Virginia & Georgia—Knoxville, Tenn.

Plants Having Cross Erecting Shops with Transfer Table.

Lac, Wis., Wisconsin Central; Denver, Colo., Colorado & Southern; Pocatello, Idaho, Oregon Short Line.

Group II.—Cross shop, with transfer table at plants with separate locomotive department: West Albany, N. Y., New York Central; St. Paul, Minn., Chicago, St. Paul, Minneapolis & Omaha; Chicago, Ill., Chicago & North Western (Kinzie street shops); Jackson, Mich., Michigan Central; Chicago, Ill., Illinois Central (Burnside shops); Depew, N. Y., New York Central; Knoxville, Tenn., East Tennessee, Virginia & Georgia; Baring Cross, Ark., St. Louis, Iron Mountain & Southern; Oak Grove, Pa., New York Central; St. Paul, Minn., Great Northern (Dale street shops).

Group III.—Cross shop with heavy overhead crane for traversing engines: Reading, Pa., Philadelphia & Reading; McKees Rocks, Pa., Pittsburgh & Lake Erie; Collinwood, O., Lake Shore & Michigan Southern.

Group IV.—Longitudinal shops: Altoona, Pa., Pennsylvania (Juniata shops); Concord, N. H., Boston & Maine; Du Bois, Pa., Buffalo, Rochester & Pittsburgh; Elizabeth, N. J., Central of New Jersey; Omaha, Neb., Union Pacific; Topeka, Kan., Atchison, Topeka & Santa Fe; Montreal, Canada, Canadian Pacific.

From an examination of the tables and with due regard to the special conditions existing at the various plants, the following average figures can be given as a general rule for proportioning *large* locomotive repair shops:

1. Floor space per erecting pit in sq. ft.:		
Erecting shop	1,750	
Machine shop	2,450	
		4,200
Boiler shop		1,575
Blacksmith shop		1,225
Total of four main departments		7,000
Additional buildings		1,750
Total, all buildings		8,750
2. Relative size of four main departments in percentage of erecting shop:		
Erecting shop	100	
Machine shop	140	
		240
Boiler shop		90
Blacksmith shop		70
Total of four main departments		400
Additional buildings		100
Total, all buildings		500
3. Relative size of four main departments in percentage of total of the four departments:		
Erecting shop	25	
Machine shop	35	
		60
Boiler shop	22.5	
Blacksmith shop	17.5	
		40
Total of four main departments		100

4. Relative size of the three main departments in percentage of total of the three departments:

Erecting shop	30.3	
Machine shop	42.4	
		72.7
Boiler shop		27.3
Total of three departments		100.0

The above figures for boiler shop include tank shop. Where the blacksmithing is absolutely for the locomotive department, the above percentages for blacksmith shop can be reduced.

The above recommended averages will give larger floor areas than are found in small division shops, where all departments for locomotive and car repairs are grouped around one transfer table.

The tables indicate that in nearly all modern plants the machine shop is made at least equal to the erecting shop, and generally larger, emphasizing the necessity of having ample machine room to back up the erecting work, so that the erecting pits do not become merely engine storage pits.

(To be Continued.)

Water and Rail Terminals.*

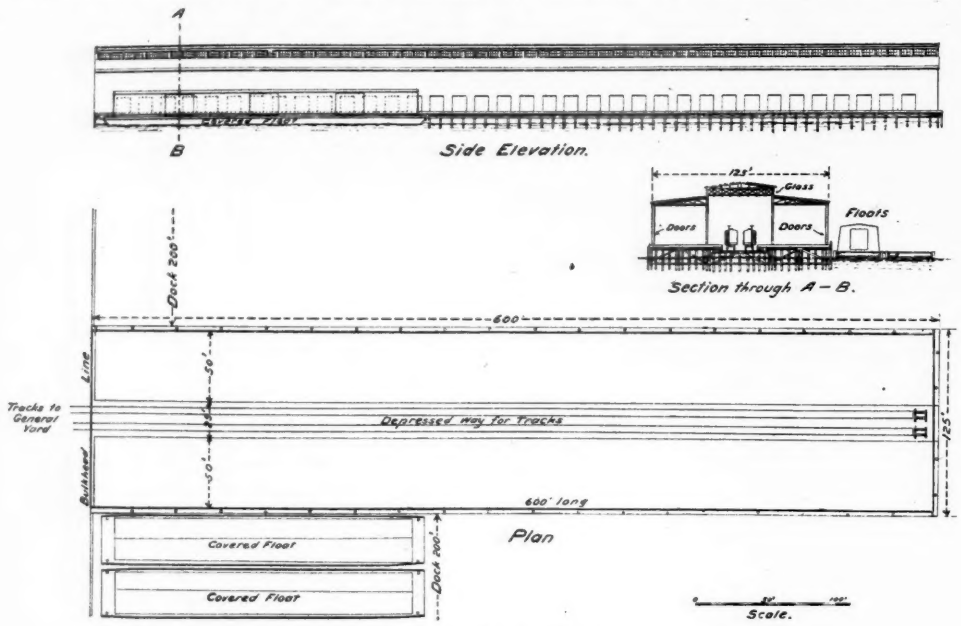
Covered Lighterage Piers.—These should be about 600 ft. long and about 125 ft. wide, with two tracks in the center, built at such an elevation that the floors of cars will be level with the deck or floor of pier. It is sometimes recommended that the sides of the pier should be composed entirely of iron rolling or folding doors, but on consideration this feature does not seem to be desirable. It cuts down the storage space and very frequently it will be found that the post between two doors will obstruct one gangway to a lighter. Most lighters have but two gangways, and where a railroad company handles the bulk of its lighterage business, the lighters are usually built with a standard spacing for the gangways, so that the doors of the pier can be spaced to accommodate the gangways. There should be a platform 4 ft. wide, outside of the walls, on the three water sides of the shed, the platform being provided with mooring piles or posts for securing vessels. Many of the older piers were built with sides having an inward slope or batter of about 1 in. to the foot, or usually about 3 ft. in the height. This was done so that in loading or unloading lighters the packages would not strike the sides of the building. This contingency is better provided against, however, by making a wider platform outside of the building, and, in fact, practically all modern pier sheds are built with vertical sides.

The shed or superstructure of the pier should be of steel frame construction or slow-burning mill timber construction. If wood is used, it should be whitewashed, to prevent sparks from setting fire to it. In large cities the law usually requires steel construction. The height of the floor above mean tide will vary with the kind of vessels to be handled and with the daily tide changes. These must all be carefully studied in order to arrive at the proper height above mean tide at any given location. Usually such height as will make the deck of the pier and boat at the same elevation at mean tide will be the most satisfactory. Between piers there should be a water space of about 200 ft. The tracks running into the pier should be so arranged that they will feed directly to and from the proper part of the general yard without interference. This type of pier will be often used for export

*Extract from report of Committee on Yards and Terminals, Amer. Ry. Eng. and Maint. of Way Association.

business, and will then take on the features of an export pier and be built accordingly. In weighing freight, automatic scales are being used, and should result in a reduction of expense.

Open Lighterage Piers.—These should be about 35 ft. wide and 600 ft. long, with a 6-ft. platform along each side. In many cases only two tracks are used, but long piers or piers which have more than two berths along each side should, however, have a third track, connected with the others by crossovers. This facilitates the shifting of cars and enables the berths at the outer end of the pier to be served without disturbing the work that is being done at the other berths. A pier with three tracks should be 45 to 50 ft. wide, and with tracks at least 11 ft. 6 in. center to center. The floor of the pier may be depressed so as to bring the car floors level with the 6-ft. platforms on each side. This, however, is not usually done.



Covered Lighterage Pier.

For most freight that is handled by derricks, the boom derricks on the lighters are used, but the pier should have a power crane or derrick of greater capacity for handling freight that is too heavy for the lighter derricks. This crane may either be stationary (in which case the lighter must be moved to the crane), or it may travel by power along the platform to any desired point. Traveling cranes of this type are extensively used at water terminals in Europe. Heavy freight, however, is usually handled by special lighters with powerful derricks, as the freight may have to be discharged at places where pier derricks are not provided. Stationary cranes for handling heavy loads, cases of glass, machinery, etc., are also of advantage. There is undoubtedly much room for the improvement of freight handling facilities at piers, largely by the introduction of machinery for the purpose of effecting greater rapidity and economy than are possible under the common method of employing men with trucks or slow hand winches and derricks. At European water terminals, traveling power cranes are extensively used along the sides of piers and docks.

The piers should be built at such a height above water that cars to be unloaded can be most conveniently handled. A study of the tides and the freeboard of boats is necessary to arrive at this height. Owing to storms and specially high tides it is necessary to build the piers at a height above mean tide slightly greater than that at which it would work to the best advantage. There should be an open water space of at least 150 ft. between the sides of these piers. This space would prevent boats from being blocked in, and would give space for a tug with lighter alongside to pass through two lines of boats and bring a barge from the bulkhead or land end of the pier to the stream (or vice versa), without interfering with the loading of boats alongside of the piers. Ample space will be found advantageous when the ice is running free.

The piers should be so located that cars will feed directly to and from the proper part of the cluster or general yard with the minimum amount of interference. The pier is principally used for the handling of coarser products moving in gondola or flat cars. It is frequently built wider than described where stone, pig-iron or freight requiring storage on the dock is to be handled. These conditions, however, will vary with the conditions of each road. The pier above described is the type best adapted for the handling of such business as will not have to be unloaded and held or stored on the pier.

Export and Storage Piers.—An export pier should be about 600 ft. long and about 125 ft. wide. On account of the great height of ocean steamers, it should usually be double-decked, the decks to be—first story, 20 ft. head room; second story, 18 ft.; height at eaves, about 43 ft. The pier should be surrounded with a 6-ft. platform, arranged with the proper number of mooring piles for tying up vessels. The pier should be provided with a proper number of fire hydrants and a general system of fire protection, included in which a chemical engine is desirable. There should be two tracks running down the center of pier, arranged at such an elevation that the floor of cars will be level with the deck of the pier. The general features and requirements for storage piers are similar to those of covered lighterage piers, already described.

If possible, at least one track should be provided on the upper floor. In any case, there should be a proper number of elevators for moving freight from floor to floor, and more elevators will be required if the second story is not provided with a track. In case flour is to be handled, and there is no track to the second story, it will be found desirable to supplement the elevators by an endless barrel conveyor, such as is used in flour warehouses. The use of this type of conveyor is recommended for any special kind of commodity of which a great quantity is to be handled. Inclined chutes leading from a trap in the upper floor to the side of the pier may also be used for sending bagged flour direct to boat by gravity. The chute is hinged at the upper end, and its lower end has a telescopic portion which may be adjusted to deliver the bags where required. If bonded goods are to be handled, it will be necessary to divide off part of the house as a bonded warehouse.

The double-deck pier has a number of advantages over a single deck. The foundations are little, if any, more expensive, and it has approximately double the floor space, while, comparing floor space with roof, the cost of roof is only one-half that of a single deck. The amount or real estate required is only about one-half. These advantages are very great when the enormous value of terminal real estate is considered. Very frequently the second story of these piers is so arranged that immigrants can be handled.

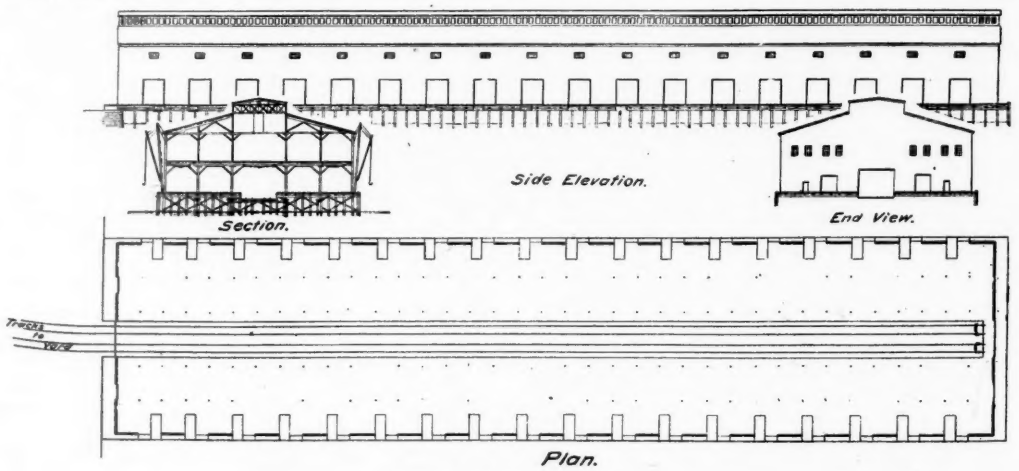
It is frequently desirable to have an open track alongside of export piers, as the character of goods to be handled is often such that they can be unloaded directly to or from the steamer and the car. This applies where the commodity is bulky and can be loaded in open cars, and in such cases it is frequently desirable to have this track. It saves the handling of goods to the floor and from the floor to the car, or one handling. At certain European ports various types of traveling gantry cranes are used, and greatly facilitate the handling of freight.

The storage pier has many of the features of the covered lighterage pier, but is designed primarily to accommodate the large ocean-going steamers, while the other pier is built to store only goods for harbor lighters. The export pier is for the handling of general export business. It often happens, however, that the business of one road will be very largely made up of flour, paper, tobacco, or some special commodity. In such cases the description above will hardly answer, and the design is made to meet the special requirements of the traffic. In the case of flour, which usually has to be held a long time, the pier should be several stories high, and the stories should be only about 10 ft. high in clearance. Cutting down the height of the stories saves in the cost of the building, and also in the labor of tiering up freight to a great height. In the flour storage warehouses all floors are reached by elevators, usually hydraulic or electric, and by endless-chain conveyors. Each warehouse should have platform elevators to facilitate the handling of trucks, etc., from floor to floor. With these arrangements, goods can be handled to and from any floor at very little cost.

Freight Station Pier and Team Track Delivery.—In many harbors there are freight stations having no rail connections, and at which freight is received and delivered by car floats. The piers at these stations should be about 600 ft. long and 125 ft. wide. This width will allow for a 35-ft. driveway in the center, and 45 ft. storage space on each side. Where the tides will allow of it, the driveway should be located at a level about 2½ ft. below the storage floor. In working out the height of the deck of pier, the height of car floats, and fall and rise of the tide, and mean tide must be carefully considered. Ramps should be provided, as noted for open lighterage piers. The pier should be surrounded on its three water sides with a 3-ft. platform, arranged with the proper number of cleats and mooring piles for tying up car floats. Along the water street should be built a bulkhead in connection with each pier 325 ft. long, to permit the laying up of two rows of car floats on each side of the pier.

The pier will be used for inbound or city delivery freight, which in the morning will be moved from the cluster or general yard on car floats and placed alongside of the pier. The cars are at once unloaded. Outbound freight will be received alongside of the bulkhead and moved by trucks over the ends of car floats and on to the platform between the lines of cars on each float. In this way none of the outbound freight will pass through the pier proper, and all interference will be done away with. Inconvenience will only be had when the inbound freight is arriving so late in the day that the outbound must be loaded at the same time. During the morning hours it is customary to store the outbound freight on the floor of bulkhead until some of the cars containing inbound freight have been unloaded. It is then moved directly from the wagon as it is received over the scales and into the proper car.

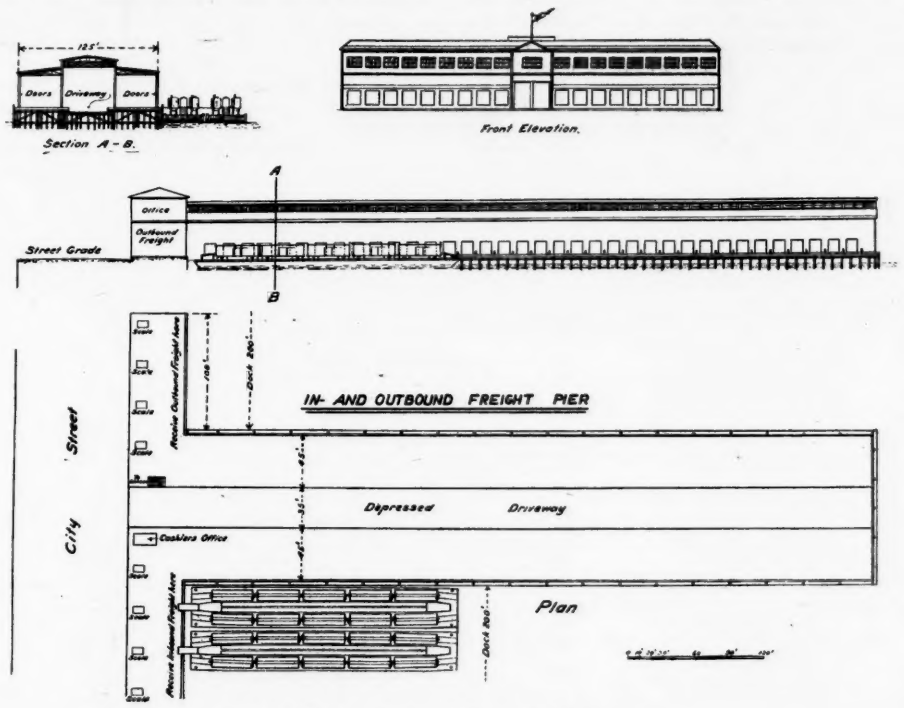
Open Lighterage Pier.



Export and Storage Pier.

In the design of these piers the same principles and requirements must be considered as in the case of covered lighterage piers. It is specially important to provide them with fire hydrants and possibly a chemical engine. Adequate roof lights should be arranged for, the lighting at night to be by electricity. It is usually not best to

double-deck the pier, but the bulkhead should be two stories high, the second story to be occupied by offices for the agent and his staff, and for the storage of records. Where much fruit is handled, it will also be necessary to provide an auction room on this floor for the sale of fruit. It will often be found necessary to provide a water tank at the extreme end of the pier for supplying tugs with water. Alongside of the roadway, leading into the pier at the front end of the bulkhead, should be provided



Freight Station Pier and Team Track Delivery.

a small office for use of the cashier in issuing freight bills. This will do away with the necessity of teamsters going to and from the office on the second floor to pay their freight and leaving their teams unprotected and blocking the driveway. It will be found to greatly expedite the movement. Scales for weighing freight should be provided at proper intervals along the bulkhead, with small houses in connection with each for the receiving clerks and the weighmasters. These piers are frequently divided up alphabetically, so that goods for any person can be easily found. At some other points this classification is made by commodities, eggs being unloaded at one location and glass at another. Water closets should be provided both on the office and on the lower floor. A lamp room is usually necessary, as it is difficult to reach the cars on car floats with electric lights, so that lanterns are generally used. This room should be as nearly fireproof as it is possible to make it.

Similar accommodations can be had by buying a block of property and building on it the usual inbound and outbound freight stations, arranging the tracks from them to lead to a transfer bridge, so that cars can be moved between the freight houses and car floats. For operating the yard it will then be necessary to provide a small dummy engine, or to handle the cars by electric power. The team tracks at such points are usually arranged in pairs, with the proper spaces for roadways. These tracks connect with ladder tracks leading to the transfer bridge. The arrangement will depend largely upon the shape and size of the property acquired, but a typical plan is shown herewith.

Coal Piers.—These are really open lighterage piers so arranged that coal from hopper-bottom cars can be readily discharged into vessels and barges. This arrangement makes it necessary to build the piers at a considerable height above the water. The height of the vessels to be loaded varies greatly. The coal is dumped directly from the car into a coal pocket, from which the coal is led through a chute to the vessel. The chutes are so arranged that they can be lowered, raised or extended, and in this way can be made to reach the proper part of the vessel. Where hard coal is handled, it is necessary to furnish the chutes with screens for eliminating dust from the coal. A coal pier is usually made up of three tracks. The outside tracks are occupied by the loaded cars. As these are unloaded, they are moved ahead and drop back to the middle track, which should be built on a grade falling toward the general yard, so that when the empty cars once get on this track, they will feed naturally into the yard. The grade of the tracks on which the loads stand should be such that they will feed toward the outer end of the pier, to enable them to be easily shifted to the middle track. This arrangement of grades enables cars to be handled quickly, gives a greater capacity, and reduces the cost of handling. Coal piers which are exceptionally long should have five tracks, connected with suitable crossovers, so that cars can be moved around those which are unloading at any particular berth.

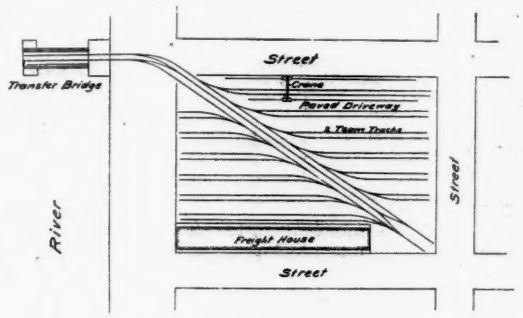
There should be a coal pocket provided for each car, and any number of them can be provided. The grade leading from the general yard or cluster to the coal pier should be made as light as possible, as it is very difficult switching up the heavy grades which are usually necessary at such points. At a convenient point should be located a coal yard into which coal cars are switched in the order in which they should be run up on the trestle. Coal piers should have a water space between them of about 150 ft. Where a large business is done, it will be necessary to provide at some point in the harbor close to the coal pier a stake boat to which all barges to be loaded are tied.

Some companies at the present time coal their tugs and other vessels at their regular coal piers. It is felt that this is not desirable, as it interferes very seriously with the handling of coal on the coal piers, unless it is done at night, and it would be advantageous to build a small pier for such use at a convenient location.

DISCUSSION:

The President: Any objection to conclusion No. 2?

Mr. W. G. Berg (Lehigh Valley): The attempt is here made to specify distinctly the exact width, length and conditions governing lighterage. The question is so complex, there are so many different conditions, that it cannot



Freight Station and Team Delivery.

be done. It is not possible to put it in this concise shape without any definitions ahead, without any explanations of what the conditions are that the committee is trying to conform to. This general argument will hold to most of the conclusions, namely, that the committee while endeavoring apparently to reach general conclusions on the subject of the principal structures, relating to water rail terminals, have drawn conclusions from, in some cases, small, and in other cases special structures which are not typical of the general class, but are special.

Mr. R. C. Barnard (Pa. Lines West): I move that we substitute for recommendation No. 2 the following: "When property and other conditions will permit, good practice would dictate a length of approximately 600 ft., and a width of approximately 125 ft., with two tracks in the center, and a clear water space of about 200 ft. between adjacent parallel piers."

The substitution recommendation was accepted.

Mr. Berg: In regard to open lighterage piers, I offer the following amendment to the conclusion:

"Open Lighterage Pier.—This should be preferably not over 600 ft. long. There should be from two to five tracks on the pier, making it from 30 to 100 ft. wide, with crossovers between the tracks, dependent upon the length of the pier; number of berths on each side, class of commodities handled, method of handling, mechanical transfer appliances, and whether space for temporarily storing, assorting or inspecting materials has to be provided on the pier. The outside track should be located with reference to the face of the pier, according to the class of freight to be handled, method of transfer, variation of water level, and freeboard of vessels. The width of slip between adjacent parallel piers should be from 150 to 250 ft., dependent on length of piers and style of vessels, generally, however, for piers not over 600 ft. long, and a width of 200 ft. is ample."

The amendment was adopted.

Mr. F. H. McGuigan (Grand Trunk): You say the pier should be two stories. I would add, "where conditions warrant or require." We handle some export stuff, and we find that a single-story freight shed is very economical and convenient, and we find if it was only 125 ft. wide, there would be times when we would have our cars tied up. We have vessels coming in that take 800 to 1,200 tons miscellaneous freight, grain, cotton and package freight of all descriptions, and we sometimes have a full cargo in the shed. If the shed is only 600 ft. long, and 125 ft. wide, we find it very difficult to get one-half of the cargo of a modern vessel into the shed. My opinion is that it should be 200 or 300 or 400 ft. wide, in accordance with the class of traffic you expect to handle.

Mr. Felt (Gulf, Colorado & Santa Fe): These dimensions are much smaller than now in use at Galveston. We have several piers there over 200 ft. in width, and from 1,200 to 1,400 ft. in length, owned by the wharf company. Recently the Southern Pacific built a pier for its New York business which I think is about 1,300 ft. long and 575 ft. wide. At Galveston, we have no two-story wharves; they are all one-story. The business there is principally cotton, and they have to provide a very large storage room for bale cotton and cotton products.

Steel Production in 1902.

The semi-monthly Bulletin of the American Iron and Steel Association makes its annual estimate of the production of Bessemer steel in the United States in 1902, and of Bessemer steel rails by the producers of Bessemer steel ingots. The total production of Bessemer steel ingots and castings in 1902 was 9,306,471 gross tons, as against 8,713,302 tons in 1901, an increase of 593,169 tons, or 6.8 per cent. The increase in 1901 over 1900 amounted to 2,028,532 tons, or over 30 per cent. The production of 1902 was the largest in our history. The following table gives the production of Bessemer steel ingots and castings in the last six years. Of the production last year, 10,466 tons were steel castings, as against 6,764 tons in 1901.

Years.	Bessemer ingots.	Years.	Bessemer ingots.
Gross tons.		Gross tons.	
1897	5,475,315	1900	6,684,770
1898	6,609,017	1901	8,713,302
1899	7,586,354	1902	9,306,471

The production of Bessemer ingots and castings by States in the last four years is as follows:

States.	1899.	1900.	1901.	1902.
Ingots.	Gross tons.	Gross tons.	Gross tons.	Gross tons.
Pennsylvania	3,968,779	3,488,731	4,293,439	4,379,516
Ohio	1,679,237	1,388,124	2,154,846	2,528,802
Illinois	1,211,246	1,115,571	1,324,217	1,443,614
Other States	727,092	692,344	940,800	954,539
Total	7,586,354	6,684,770	8,713,302	9,306,471

The production of all kinds of Bessemer rails by the producers of Bessemer steel ingots in 1902 was 2,876,293 gross tons, against a similar production in 1901 of 2,836,273 tons, in 1900 of 2,361,921 tons, and in 1899 of 2,240,767 tons. The maximum production of Bessemer rails by the producers of Bessemer steel ingots was reached in 1902, but the increase in that year over 1901 amounted to only 40,020 tons, or 1.4 per cent. As compared with 1887, 15 years ago, the increase in 1902 in the production of Bessemer rails amounted to only 831,474 tons, or 40 per cent., while during the same period the increase in the production of Bessemer ingots amounted to 6,370,438 tons, or almost 217 per cent. The following table shows the production by States of Bessemer steel rails by the producers of Bessemer steel ingots in the last four years. The figures do not include a small quantity of rails made each year from purchased blooms or from re-rolled steel rails, statistics for both of which products for 1902 are not yet available.

States.	1899.	1900.	1901.	1902.
Rails.	Gross tons.	Gross tons.	Gross tons.	Gross tons.
Pennsylvania	1,224,807	1,195,255	1,406,008	1,148,425
Other States	1,015,960	1,166,666	1,430,265	1,727,868
Total	2,240,767	2,361,921	2,836,273	2,876,293

The Bulletin also gives the following table classifying rail production according to the weight of the rail. Bessemer rails made from purchased ingots or from re-rolled rails are not included.

States.	Under 45 lbs.	45 lbs. and less than 85.	85 lbs. and over.	Total.
Rails.	Gross tons.	Gross tons.	Gross tons.	Gross tons.
Pennsylvania	53,964	766,567	327,894	1,142,425
Other States	173,104	1,237,496	317,268	1,727,868
Total for 1902.	227,068	2,004,063	645,162	2,876,293
Total for 1901.	140,214	2,202,237	593,822	2,836,273
Total for 1900.	154,796	1,605,067	602,058	2,361,921

In addition to this, 63,522 tons of iron and steel rails were imported last year, but to balance this importation 67,666 tons of iron and steel rails were exported. In 1901, 318,956 tons of rails were exported, and only 1,905 tons were imported.

Large Freight Cars in Prussia.

In the discussion over the estimates of the State railroads in the Prussian Diet, the Minister of Public Works, General Budde, in answer to suggestions that great economy might be secured by substituting freight cars of great capacity for the four-wheeled cars now in use, said the use of such cars depended upon the shippers as well as the railroads. All their efforts to induce the shippers to use the large cars had failed, because the appliances at the coal mines, etc., were not adapted for them. If the railroad system was to be built new, then probably the large cars would be adopted, and superstructure, turn-tables, etc., constructed accordingly. The Minister had consulted with the shippers and receivers

of freight who objected to the large cars, and asked them to tell the administration what they wanted. These had held conferences and had declared in favor of 25 and 30 ton cars (55,000 and 66,000 lbs.), on condition that rates be reduced for shipments in such cars. Negotiations were still pending. The administration had ordered 200 cars of 44,000 lbs. capacity, in which the proportion of dead weight to load is as favorable as in the American 50-ton cars. The 10-ton (22,000 lbs.) cars now in use (chiefly old) have 42 per cent. dead weight; the 15-ton cars (the present German standard), 36 per cent.; the new 20-ton cars, 25 per cent.

Low Pressure Power Interlocking at Salisbury, England.

The British Pneumatic Railway Signal Company, organized in 1900, using the patents of the Pneumatic Signal Company, has installed electro-pneumatic automatic signals on the London & South Western from Grately to Andover Junction, as heretofore told of in the *Railroad Gazette* together with interlocking at Grately, and the road has decided to work all block signals and interlocking plants between Woking and Basingstok Junction, 23 miles, by the low pressure pneumatic system. Two large interlocking plants at Salisbury were completed and put into operation in November last, and the lay-out of tracks at this place is shown in the accompanying drawings.

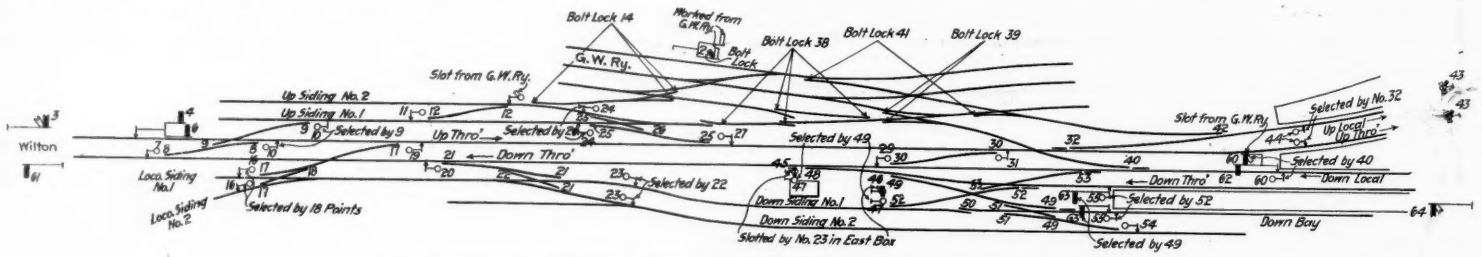


Fig. 1.—Interlocking at Salisbury—London & South Western Railway—West Cabin.

At each end of the station there is a cabin; the cabins are known as the east and west boxes. These two cabins and the ground frame, which is shown at the extreme right in Fig. 2, do all the work which formerly was done by four mechanical machines. The ground frame is only used during the time that shunting is going on at that point, and has been rendered necessary to meet the requirements of the Board of Trade.

The west cabin contains a 64-lever frame of the usual pneumatic type. Twenty-two of these levers work 30 signals, 19 are for switches and five for bolt locks between the Great Western Railway and the west box; in addition to these there are two special lock levers controlling signals operated from the east cabin, similar to those for the east box and ground frame, and 16 spare spaces. The east cabin contains a 64-lever frame, 27 of which work 32 signals, 17 are for switches, three special lock levers and 17 spare spaces. Signals connected with one cabin and controlled by electric slot from the other are indicated by a special symbol, as at signal 43, west cabin.

The compressed air for working the whole of the switches and signals is obtained from one power house situated near the east cabin. All the levers operating the running signals are replaced electro-pneumatically by apparatus controlled by track circuits with which all the running lines of the station are provided. For example, a train on the up through line will get the distant No. 3, home signal 6 (west box), signals 2 and 5 (east box); on passing 6 the lever in the cabin will be replaced electro-pneumatically since the train has broken the circuit, by entering the section past the signal. As long as the train is in the section between signal 6 and switch 14 the lever of signal 6 will be held by the air pressure; and the signalman in the east box cannot pull No. 2 signal again until the train has cleared the section commanded by it. A train on passing No. 2 signal (east box) will, it is true, hold that signal and the lever operating it in the normal or danger position, but directly the indication has been received (which might be the case if the signalman replaced the lever himself) that that signal has gone to the normal or danger position, the conflicting locks are free and it would be possible, unless some other means were employed to lock these, to move conflicting switches and so run the risk of a collision. Therefore a lever is provided which, when pulled, mechanically locks all conflicting signals and switches immediately fouling the up through line. This lever is held electro-pneumatically by the circuit in the track between 2 and 5; and as long as this portion of the track is fouled in any way this extra lever is electro-pneumatically locked.

In several cases in this station one lever will operate one of two signals. Which one it works is dependent on the position of the switch leading to the track over which these signals give permission to run. For example, in the east box lever 62 of the signal for the down through line, works one of two home signals, depending on the position of the switch 39; when 39 is normal the right hand signal is operated, giving the train permission to run to the down local line, diverging at switch 24. If 39 be changed the left hand, 62, comes off, indicating to the driver that the train will have to run to the down bay. Switch No. 24 is held by a special "retaining lock lever" No. 61, which when pulled over is locked in that position as long as there is a train on the main line between signal 62-63 and the switch. This is done by means of the track circuit. If the lever of switch No. 39 is reversed, 24 is not held by 61, so that movements can be made through 24 and 26. No. 61 will release signals 27, 48, 52, 56, 62 and 63, but will be left free of all trailing points. At the west cabin there is a similar retaining lock lever (No. 5) for the up local and through lines. It holds switch No. 32 and when pulled over is locked in the same manner as in the case of No. 61. (For straight through movements on the down through line, signal 63 is cleared.)

The dwarf signals used at Salisbury are of the semaphore type, though they are shown on the drawing as round disks. The dwarf semaphore arms are made of rubber, more convenient and safe where the space between tracks is narrow. All the signals, both on the ground and on the high posts are lit by electricity, and the lamps themselves, fitted to a hard rubber base, connected with flexible wire to the main, are contained in a cast-iron lamp case so that in case of need these can be lifted out by a handle, which is provided, and an ordinary oil lamp be substituted. The current for the lights and also for running the motor driven compressor is supplied by the City Electric Light Company.

Fig. 3 shows two of the electro pneumatic automatic block signals put by the British Pneumatic on the London & South Western.

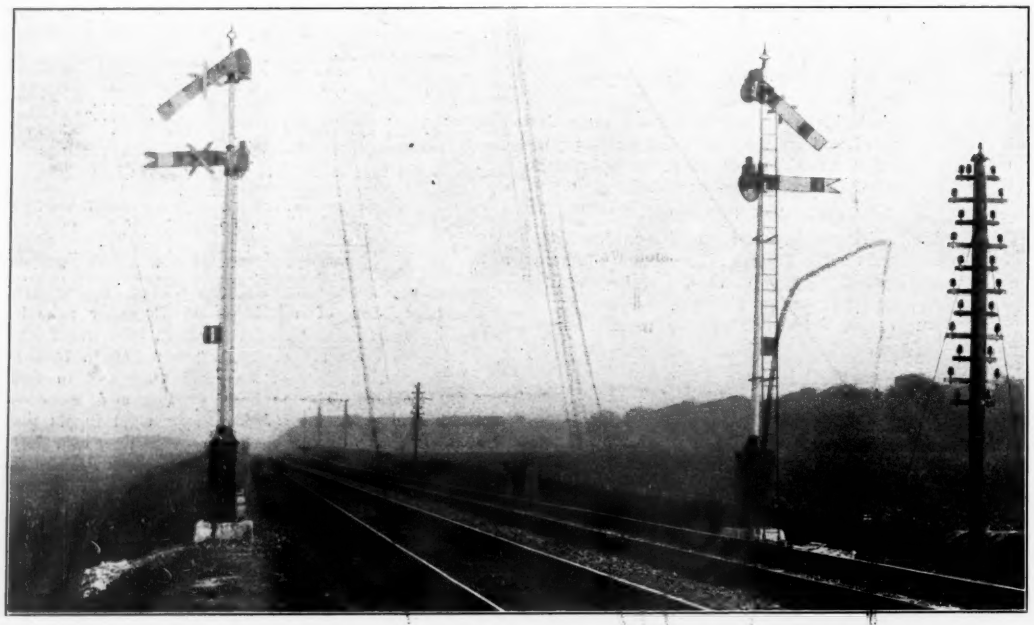


Fig. 3.—Automatic Signals on the London & South Western, Between Andover Junction and Grately.
Trains Run on Left-hand Track.

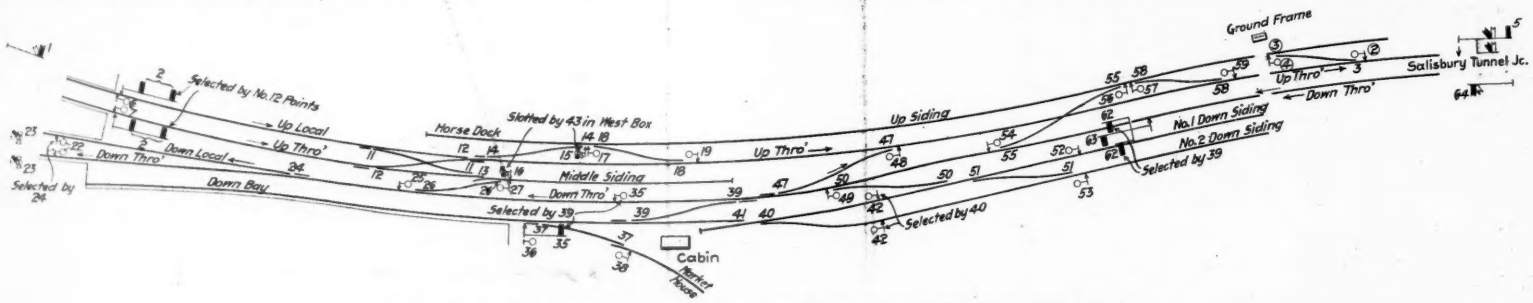


Fig. 2.— Interlocking at Salisbury—London & South Western Railway—East Cabin.

Drainage of English Railroads.

BY EDWARD DAVY PAIN, *Student Inst. C. E.*

Undoubtedly the portion of a line where suitable and adequate drainage is most needed is where the formation of the ground necessitates a cutting. For, at the outset, if good temporary drainage of cuttings be insisted on by the engineer during the progress of excavation, endless bother and trouble with the bank will be saved, owing to the material being kept more or less dry and thus being less likely to be converted into slurry (semi-fluid clay) during its passage to and over the tip-head.

Often a good deal of modification and improvement upon the original plan is necessary before the stability of the slopes is ensured.

An instance of this is recorded on the London & Birmingham Railway, where it was found necessary to bore horizontally through a retaining wall between Euston Square and Camden Town. Perforated iron pipes were then introduced in an upward inclined direction, which effectually drained the water out of the clay at the back of the wall and prevented any further bulging. Curiously enough, when the wall was removed in parts the clay stood well without showing any fissures. The movement was supposed to have been caused by the combined action of the air upon the surface, and that of rain and surface water percolating through the upper strata and acting behind them, forcing the earth forward in the least line of resistance. In some other parts on this same line benches on the face of the slopes were when formed found to act injuriously in draining them, as they were too apt to catch the rain and surface water.

In Blisworth cutting the movement was treated as one mass slipping upon another. The mass was divided into vertical sections by excavating perpendicular chases 5 ft. wide right through the slip into solid clay below. These chases, now usually spoken of as counterforts, were 15 ft. apart, being filled with rubble masonry or with chalk and gravel well rammed down, forming a solid immovable mass. The slip was thus divided into small portions, and restrained from further movement by the friction against the counterforts. The trouble in this cutting was attributed to the presence of large spoil banks on the top of the slope which effectually prevented the surface water from draining away, aggravating the movement at the same

time by their weight. This method was applied extensively on the London & Birmingham Railway in dealing with slips.

In Brentwood Hill cutting on the Great Eastern Railway several slips occurred owing to the slimy nature of the silt. The water could not be extracted by itself, the tendency being for the silt to flow away with it. In the worst places the following treatment was adopted. A fence ditch was cut at the top of the cutting. A benching half way down was formed to a width of 10 ft. Ordinary side drains were put in at the foot of the slope with drain pipes running in various directions along the face of the slope. To facilitate the flow on the benching a culvert was added. Then gravel counterforts were inserted. Finally wells were adopted, being placed in the wettest spots; steened (stone-walled) until 3 ft. from the bottom, where a ring of brickwork four and a half inches wide was built in cement. Their diameter was 3 ft. 3 in. and the depth from 15 ft. to 20 ft. In the lower part of the slope 25 wells of the same diameter 10 ft. deep were added. In less troublesome parts a more simple and inexpensive plan was tried, which proved quite successful. A narrow trench was cut along the wettest part of the slope as deep as it could be excavated without much shoring up the sides; a small culvert was laid in the bottom having an outfall into the open drain at each end. On the lower side a puddle wall was raised and at its back a dry rubble wall with straw above it to prevent the sand and loam from washing into and choking the interstices.

In the Acton cutting of the Great Western Railway great difficulty was experienced in getting ballast. As, however, there was a large surplus of excavation, clay was burnt to form an open backing to collect water and also for mixing with soft clay which was punned (rammed) back again. Continuous abutments and revetments were formed upon the original face, in all cases thorough drainage from the back being ensured.

At Ruscombe cutting the gravel stratum was removed from the top, the surface of the clay being laid bare and well drained. The gravel was used as a footing or buttress below at such portions of the slip as had been forced up by previous slips; when there was under-drainage from longitudinal culverts this plan answered very well.

Again in Sonning cutting, where the gravel bed overlay the clay, the upper stratum was broken into by an upraised bank of clay which formed a dam and after much wet weather kept a reservoir of water penned back until it broke out the mass of clay down to the next stratum; where the dam was cut across for purposes of drainage that part of the cutting became particularly dry. A drain was led from the back of the dam in dressing off the slip.

The Swindon embankment of the Cheltenham & Great Western Railway was barrow-tipped during a very wet season. Such a combination is bad for any clay bank owing to the irregularity of surface hindering drainage and less compression of the material during construction. The height of the bank ranged from 20 ft. to 24 ft., and large portions of the slope were burnt where slips occurred; dry rubble and sand also being used for making good elsewhere. Directly the line was opened for traffic the up or east side slipped again badly, so much so that the whole of the soft material was forced or removed out, the side cutting filled up and a dry stone wall 12 ft. thick put in to a depth of 10 ft. at the bottom of the slope. The embankment, in fact, was almost re-formed of rubble.

The geological position and not the nature of the ground was the cause of a bad slip in the Ashley cutting on the Great Western Railway. The line was set out as it proved through the deepest part of drift which had accumulated over beds of lias (fossiliferous limestone) marl, above which lay inferior oolite, fuller's earth, and upper oolite. The bottom of the cutting was in places on the marl. The drift being full of water slid down and choked the cutting. The broken ground was removed to a slope of 4½ to 1; drains filled with rubble stones and faggots proved useless as they were choked, so further measures were taken. The marl at the bottom was reached, much of the drift being removed first. Headings were driven from the valley into the hill and connected by shafts, sunk to meet them, which pierced the marl. These shafts and headings were afterwards connected by headings driven on the surface of the marl parallel to the railroad. Upon the high side of the cutting three benchings were cut.

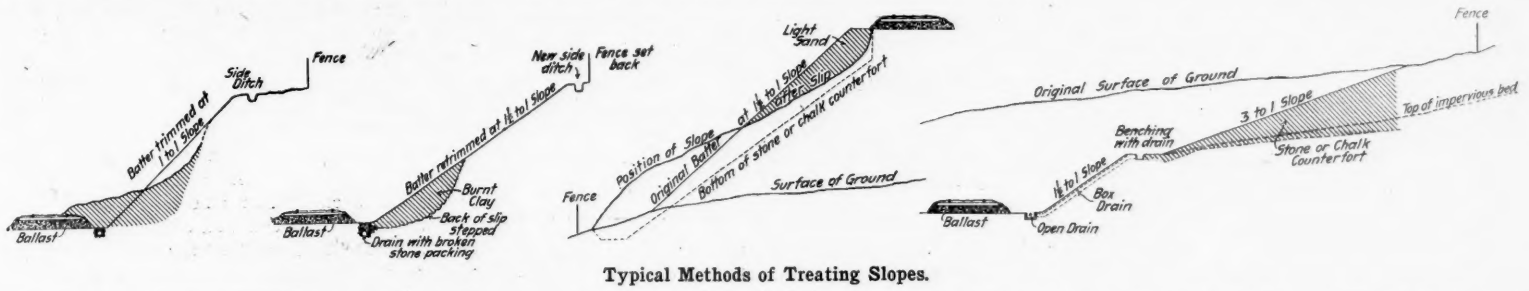
Quicksands were encountered on the Shawforth Branch Railway near Rochdale, and in no part would the slope stand at less than 2 to 1, usually 3 or 4 to 1 was the limit. Inclined roads were run up on benchings, and a retaining wall was built for 3 or 4 chains in one exceptionally treacherous place by driving piles 15 ft. deep braced together with walings at formation level, cross cut about 2 ft. higher, a dry rubble drain 1 yd. sq. being inserted at the back. The greater part of the cutting where the trouble occurred was about 50 ft. deep. The embankment formed of the material excavated from the above cutting bulged and slipped; it was made good with better material, the weak portions were supported by upright rubble drains about 20 ft. to 30 ft. apart, with relieving arches turned upon the slope in some cases to connect them and support the slope.

On the Ashby & Nuneaton Railway land drains gave trouble in the cuttings, necessitating the adoption of heading drains on the high side to intercept them. In the banks where the slips were due to the soft and perishing nature of the clay, a rubble drain 3 ft. in width was inserted every half chain to formation level, varying in depth to reach the bottom of the slurry. These drains were connected at the foot to another dry rubble drain, sometimes assisted by an earthenware pipe to the nearest outlet.

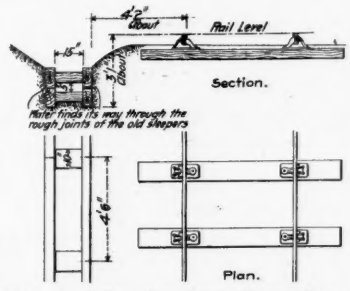
On the Chatfield & Helliburn Railway a boulder clay embankment commenced to roll away on reaching the height of 30 ft., three deep drains were therefore cut 6 ft. wide, one on the center line and one each side, and filled in with boulders picked out from the clay. These drains were connected at every chain by similar drains in a diagonal direction, an outlet being provided into a brook.

Boulder clay again was a fruitful source of trouble in the Castle Eden & Stockton branch of the North Eastern Railway; in the slopes of the cuttings deep drains were made 1 ft. below the seat of the slip, and the solid back stepped. These drains were at right angles to the line 2 ft. 6 in. to 3 ft. wide at about 20 ft. centers, and filled with slag from iron furnaces, no stone being near at hand. In some places a retaining wall was added with counterforts and a bed of slag 1 ft. thick behind. The hollows in the slopes were filled with ashes. It was also found the boulder clay became soft from exposure and though the ballast under the sleepers was 10 in. thick, after 12 months' working of the line the clay rose up, while in some places the ballast was 4 ft. deep. To remedy this a 12 in. pipe was carried up on each side of the cutting, its crown being 12 in. below the under side of the sleepers, with broken slag over it, the clay being taken out between the sleepers and extra ballast filled in.

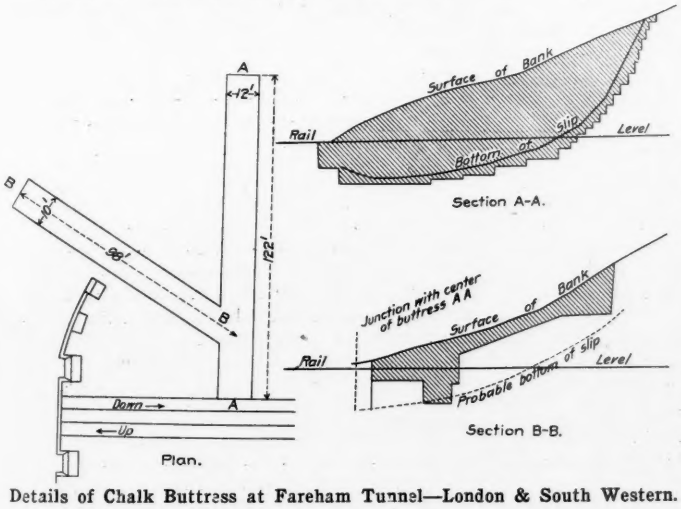
On the Nottingham & Melton Railway in lias shales two slips occurred on opposite sides of the line. The bottom of the slips pressed against one another under formation, lifting the ground several feet. Drains were laid at the back, a toe of burnt ballast put on each side, and the slips were excavated in the center line to full width from 3 ft. to 9 ft. under formation. This space was then filled in with rough furnace slag and the permanent way laid over without mishap.



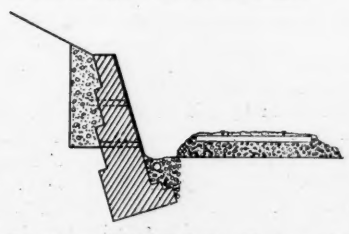
Typical Methods of Treating Slopes.



Method of Forming Cross Channeling of Old Sleepers in Wet Cuttings.



Details of Chalk Buttress at Fareham Tunnel—London & South Western.



Retaining Wall With Box Shutes and Backing of Dry Stone or Ashes.

On the Byker & Percy branch of the North Eastern Railway alluvial clay was met. The upper or light brown stratum ranged from 6 ft. to 12 ft. deep; both this and the lower bed of the clay were in flakes parted by films of fine sand holding water obstinately. Where the lower bed was pierced slips occurred; in such cases a space 15 ft. to 20 ft. was cleared until the clay was reached downwards and sideways. This done a layer of rough stones was laid down, upon which a fire was made with broken wood and coal, alternate layers of clay and small coal being superposed when the fire was well alight. This method left a surplus quantity of burnt ballast for the banks.

On the Bournemouth direct line of the London & South Western Railway, where the clay squeezed up through the ballast and the ballast was squeezed down the ditches became choked. The clay was removed and Swanage limestone 1 ft. 6 in. thick placed under the sleepers; an open channel drain or pipes laid in the ditch carried off the water. The open channel drain is formed by laying old sleepers on edge two deep, 1 ft. 3 in. apart; the cross pieces being cut out of sleepers and fixed at 4 ft. 6 in. centers.

In Fareham tunnel cutting at the high end of the tunnel water was present in such large quantities that a big drain was laid in the six foot way, 9 in. pipes covered with chalk and rough stone, for the distance of a quarter of a mile. Catchment chambers were built every 80 ft. or 90 ft., and cross drains were laid in at intervals of 70 ft. or 80 ft. At the tunnel mouth the drain was 4 ft. deep, but at the end of the cutting owing to the rise of gradient of rail level was 10 ft. to 12 ft. deep. At the other end of the tunnel, where the cutting was 80 ft. deep, slippery clay caused a slip, going 20 ft. below rail level. Buttresses of chalk 14 ft. wide, 20 ft. below, were carried up in steps according to the bed of the slip. Water finds its way through the crevices into a drain in the bottom of the cutting and is led away to a natural stream half a mile distant. This drain is 10 ft. deep, so that the bottom of the buttress for about 10 ft. always stands, as it were, in water. The treatment has proved, however, very efficacious.

Conclusion.

The following arbitrary rules, it seems, may be formulated from the data given above, viz.:

1. Always go to the bottom of the slip.
2. Avoid spoil banks at the top of cuttings.
3. Always tip the bank full width.
4. Always tip the bank full height, making due allowance for settlement, except in the case of clay and such like banks over 25 ft. in height, when two lifts are advisable.
5. Avoid letting slurry over the tip-head and always sweep snow off it.

Perhaps, too, the modern tendency is rather to wait until a cutting, or bank-slope, slips before taking remedial measures. This is due often to a desire for economical construction or lack of appreciation of geological conditions. It is curious to note how little has been written about this subject, the importance of which is self apparent to all those who have had to do with railroad construction; the reason is not far to seek, so much depends, in fact, upon the locality and the exact nature and position of the strata that each slip requires individual treatment, and in the majority of cases such treatment is often designed by and carried out under the supervision of the resident engineer without the preparation of drawings and plans. The urgency of the case is the excuse given and thus no record is obtained. This article therefore does not profess to treat the subject of railroad drainage in England exhaustively, but rather to give a chronicle of methods employed by engineers from early in the last century to comparatively recent times, as recorded in Smiles' Lives of Engineers, Dempsey's Practical Railway Engineer, and the volumes of the Proceedings of the Institute of Civil Engineers, and from information privately supplied by gentlemen to whom I now tender my best thanks.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The rebuilding of the Pennsylvania railroad marks an epoch as clearly as did the building of the first railroad in this country more than 70 years ago. In magnitude, in courage and in that bold recognition of facts and their lessons which we are growing accustomed to call "imagination," it has no precedent in the history of transportation. A description in detail of the important and varied engineering works involved would be bewildering, but in these columns (March 13 and March 27) Mr. Whinery's essays on the reconstruction from Pittsburg to New York are so clear and so charming in their literary style, are written with such a dignified and appreciative grasp of the means used and the great ends aimed at, that none of us can afford to miss reading them. We preserve many foolish books and let such fine things as this in current publications slip away. The summed up result is that when the 100 and more million dollars of work is done the Pennsylvania will have a four-track line on which a locomotive can haul 85 loaded cars over the 445 miles from Pittsburg to New York, with help from a pusher at only two points—near Pittsburg and over the Allegheny mountain divide. From Philadelphia to New York there will be six tracks. Any possible congestion at Pittsburg, Harrisburg, or Philadelphia is provided for by tracks around them and by enormous new classification yards. In New York harbor the great freight terminal will be on 550 acres of made ground with a frontage of more than a third of a mile and extending nearly two miles out into the bay. Is there any other tidewater terminal comparable to this one? The thoroughness of the rebuilding is indicated by one item, that of the 105 miles between Harrisburg and Philadelphia, there is now left only one and a half miles on the original location, and even this is to be changed this year. Substantially all grade crossings are eliminated, and over stone-arch bridges and monumental constructions, on low grades with curves rarely exceeding two degrees, the greatest train loads ever known will be carried easily to the harbor of the Metropolis. For passengers, Philadelphia is simply a way station, a quiet one, since even the mild sounds at Broad street station will be altogether missed by those going through to the West or the South. New York is also a way station, for the four tunnel tracks keep right on five and three-quarter miles under the city to an apparent terminal at Long Island City. But the end is not yet, although the plans are not completed for the continuation across the mouth of the Long Island Sound to a connection with the New York, New Haven & Hartford. The estimated losses in the anthracite region last year caused by Mr. Mitchell's organization happen to be a sum quite like the estimated cost of this prodigious undertaking which promises to be a lasting benefit to mankind.

Until last Saturday, if the newspaper reports are true, the President of the New York, New Haven & Hartford refused to recognize a national employees' organization. On that day, under threat of a strike, the President decided to receive, on Monday, March 30, Valentine Fitzpatrick, "Third Vice-President" of the trainmen's national organization, for the purpose of coming to a decision as to how he should treat his own employees. In a newspaper interview, apparently authentic, the President is reported to have said, when asked if the decision to admit Mr. Fitzpatrick to their conferences was not a concession on the part of the road:

"Why, yes, somewhat. The men asked to have him come in and we didn't object."

"Was such a step ever taken before?"

"Well, we don't often have to meet any such emergencies. We are willing to do all in our power to settle the matter peaceably, and if this move will help along that end, why, we are willing to make it."

"Is Mr. Fitzpatrick called in by the men in the hope that he will succeed in ending this controversy?"

"Yes. The men want to have the thing settled, and they think this will hurry it along. So far as I know there is no railroad in the country that has a schedule of only ten hours for a day's work for trainmen. We have about 12 hours, but I think we would make that 11 hours. Of course, I can't tell what further concessions will be made on either side."

"Horseshedding" is a homely New England word used to describe an undignified bargaining. On another important road, a short time since, a like condition of unrest and dissatisfaction existed among the trainmen. Its existence and the treatment of the case were never reported in the newspapers. The General Superintendent, who was new to the position, informed himself thoroughly of every detail of the wages, hours of work and special conditions of that work, by the brakemen, conductors, firemen and engineers, and arranged with all of them to send their grievance committees to meet him at a date fixed. At these meetings he also had present those of his subordinate officers who were in direct control of the men. He appointed himself chairman of the meeting and maintained a strictly judicial attitude, both in form and in fact, while conducting a debate between the committeemen and his subordinate officers. Point by point, all that concerned the relations of the company to the employees was discussed, and an immediate and evidently irrevocable decision was given by the Superintendent. He was enabled to give this quick decision in each case because he knew his business and had made a thorough and open-minded study of what was fair and generous to the men. Every one of his decisions was accepted by the men, but this was because he is a great man and his employees were convinced that he was just. There is not at the present time among these men a field for the activities of Mr. Fitzpatrick or any other agitator.

One Consideration in Dealing With Strikes.

A railroad president whose great ability is well recognized, writes to us a letter from which these sentences are quoted:

"Certainly it is time that somebody began to call attention to one of the very serious situations with which we are faced. As it stands at the moment, public sympathy and laws as well seem to be entirely against us. . . . The trouble is not with the men themselves—those we can reach and get in touch with. But it is the continuously aggressive organizer, who is not in our employ and who feels that he must do something to earn his salary, that brings about a great deal of our trouble. . . . It is a sort of an endless chain in which one road is forced to make an advance, and then its neighbors and competitors, and it goes around until it arrives at the point of origin and is again repeated. I do not believe there is any class of labor in the world as well paid and as fairly treated as that on American railroads."

It is well, before asking for the protection of the law, before asking the courts to prohibit outside interference and before suing for damages for such interference, to be quite sure that the employees, in whose behalf the agitators are professedly acting, are being fairly treated. This is difficult, as well as to a certain extent ineffective unless, as this president says, "we can reach and get in touch with" the men. Fair treatment should mean not only an equitable, a defensible, rate of payment and hours of work of the different classes of railroad employees on the same road as compared with each other, and as compared with like classes on other roads; it should also be such as to promote individual zeal and loyalty. The skilful housewife has her house in order before a wedding or a funeral; she is ready for that amount of publicity and the possible criticisms. In these days the legal proceedings in defense of a corporation involve the widest publicity of every detail of the relations of the company to its employees, and, whatever the courts may decide, based on existing law, the jury of public opinion renders a verdict of its own, and in the end, after the passions of the moment have subsided, that verdict holds, for if the existing laws do not warrant and sustain it, new laws will be made so as to coincide with general opinion.

It is well to remember that this is a government of the people, and, to borrow the form of one of Mr. Lincoln's wise sentences: All the people may be wrong, for a while; part of the people may be wrong all the while; but the great body of the people are not always wrong. The officers of great, stable, railroad corporations can well afford to be just, and insist on the enforcement of the law; sternly just, tempered with kindness and absolute frankness in dealing with their employees, and safely rely upon the support of the decent people who finally control opinion and make law.

One difficulty in making practical use of these well-sounding platitudes is the determination of what is just. The railroad officer is a trustee. He is on firm ground when he maintains that in the execution of his sacred trust he must run his own road and not allow irresponsible persons to dictate its operation. When he knows surely, from his long training and invaluable experience, that it is for the best interests of his company and of his men to pay the engineers, firemen or trainmen either by the mile run or by the day; to have either a piece price or an hour price system in the shops; it is his duty to use his best judgment to the limit of his power. But in this there are two chances for error: He may be wrong, or partly wrong, if his conclusions are based solely on statistics, or on a star-chamber study of efficiency and cost without an equally careful study of the lives and way of thinking of his men. If he can devise some way of getting at the best of them, is it not probable that his judgment, right in the main, may be modified in some details, just enough to make the difference between success and failure?

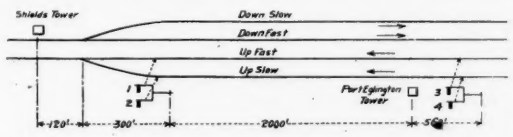
He also finds a limit to his power in carrying out his ideals because of the opposition of his men led by agitators. A speaker of the assembly of one of the great States in the Union once said that in his 20 years' experience he had never known a time when as small a number as ten men did not control all the legislation at the State capital; or when as few as three men did not control the ten. Men of experience in political caucuses believe this to be true. It is quite true of the influence of a few restless, talkative persons over any body of quiet, sober, industrious workmen. It is also apt to be true that the grievance committee is made up, partly at least, of the same instigators. In meeting the officers they are not judicial, or open to conviction; they have at stake the justification of their own previous haranguings. They have no ear for facts, soberly presented, for their influence over the men depends upon present success, or in defiance and further agitation.

It is suggested, respectfully and with considerable humility, that in this one of the many important problems of dealing with strikes, short circuiting is needed. It is not enough to say that I am always ready to receive and confer with my men, any one of them or all of them. It is a proper attitude, but it does not amount to much in dealing with large bodies, for, in practice, they appear by attorneys unwisely chosen. It seems to be obvious that the agitator could be put out of business, and most misunderstandings could be avoided if a way were devised for frequent direct communication and conference with the earnest workmen. Possibly this cannot be done, although that is by no means final. It is so much needed, it is so near to the ideal method, that the problem deserves careful study. Perhaps some fertile mind will solve it. Nothing that is worth while is very easy, and hard problems are worthy of great men.

A Detail of English Block Signaling.

It seems that in England as well as in America, signal engineers—or, rather, we suppose, the men "higher up" who cut down the financial estimates—sometimes deliberately plan to get along with one signal when they know that they need two. To the American observer, who sees

signals used as freely as telegraph poles, and who notes the enormous sums spent by the English roads on interlocking this appears at first sight incredible; but some significant facts are now and then brought out by the Government inspectors. A recent instance is found in the report of a collision near Glasgow, almost at the place of the collision referred to in our issue of Nov. 28, last (Gorbals, near St. Enoch's Station), on the Glasgow & South Western. That collision was due to irregular block working sanctioned by the company, and to fixed signals being badly arranged so that they were misread by the runner. The present case occurred at Shields, Dec. 3. Signals 1 and 2 are the up home signals for Shields tower. These signals are also controlled or



"slotted" from Port Eglinton tower to act as starting signals for that signal box, and it was this arrangement that was the principal cause of the collision. The Board of Trade inspecting officer remarks in his report that the controlling of the home signal for one tower as a starting signal for the tower in the rear has the objection that it practically abolishes the block section between the two towers. According to the rules for block working the towerman at Port Eglinton is justified in allowing a train to pass his home signals 3 and 4 and proceed towards Shields without the permission of the man at the latter place. A further factor in this case is that the runner has a bad view of the signals at Shields owing to a curve in the line and adjacent high buildings.

On the afternoon of Dec. 3 the man at Shields was allowing a train of empty cars to set back off the up line opposite the tower into the up slow line, when an up passenger train was "offered" to him by the man at Port Eglinton. This train was not accepted, but the man at Port Eglinton was justified, according to rule, in allowing the train to go forward to his starting signal i.e., the home for Shields. But before doing this—also according to rule—he should have kept his home signal at "stop" until the train was close to it and had been brought quite or nearly to a stand at it. The rule goes on to say that the runner of any train so pulled up must go slowly forward towards the starting signal. Unfortunately the Port Eglinton towerman did not stick to this rule, and consequently the runner found the home signal off when he sighted it; and, running forward, he was close to the Shields home signal (owing to the bad view already referred to) before he knew it was against him, and being unable to pull up in time he came into collision with the empty cars. It will be noticed that there is a distance of 2,000 ft. from the Port Eglinton tower to the home signals at Shields. This is too far for an advance signal to be satisfactorily worked manually and the Board of Trade officer therefore recommends that an independent advance signal be provided nearer Port Eglinton and the slotting of Shields home signal be discontinued.

So much for the facts of the case as they appear in the Inspector's report. To an American, however, one or two questions will arise as to whether, after all, the elaborate regulations which are in vogue in England are the best provision that can be made for the attainment of the perfect safety that is aimed at. The only thing that the Eglinton slot can do to the Shields home signal is to put or hold it at stop; only Shields can clear it. Wherein does this impair the security of the block signaling from one station to the other? As to the engineman's carelessness in overrunning the Shields home signal, that appears at this distance to be plain,—not modified, carelessness. Why should a curve excuse him from knowing where the signal was? If he expected to find the signal off because, usually *A* does not send a train to *B* until *B* has cleared both home and starting signals, that would look much like a safety arrangement defeating itself. One of the best uses that could be made of this collision would be to make it an argument in favor of returning to fundamentals; in favor of more thoroughly enforcing upon enginemen the simple rule to expect to stop at every signal with a square-end blade; for the enginemen to make this expectation a "continuing condition" until he is informed, either by the distant signal or by a sight of the home signal itself, that the home actually is "off."

February Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of February contains accounts of 22 collisions, 22 derailments, and one other accident. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances occurred as follows:

(*a*) †1st, Vicksburg, Miss.
(*b*) 11th, Mullan, Mont.
(*c*) 13th, Icarus, Nev. (2).
(*d*) 15th, Allegrippus, Pa.
(*e*) 16th, Gallitzin, Pa.
(*f*) *23d, Berea, Ohio.
(*g*) †23d, Athol, S. Dak.
(*h*) 25th, Kittanning Pt., Pa.
(*i*) *†28th, Lenoir City, Tenn.

The comparatively small number of fatal accidents to passengers is in gratifying contrast to the records of the three months last preceding. The worst one, that at Vicksburg, happened under such circumstances that it might almost be excluded from the list, as not occurring in regular passenger railroad transportation; but persons carried in cars on a railroad, and paying for their transportation; lawfully in the cars and killed or injured by no fault of their own, cannot well be classed as anything other than passengers. So far as can be judged by the reports, this transportation, where this accident occurred, is not different in methods or circumstances, from the transportation of passengers in passenger trains over the same route, except perhaps that passenger cars are handled by men of more skill or experience. Cases like this serve to remind us that a good many passengers are carried on freight trains; while we need no reminder that in the great majority of cases freight trains are not surrounded by the complete safeguards that are carried out for the protection of passenger trains. The Interstate Commerce Commission's accident records, as furnished by the railroads, show accidents to passengers on freight trains in a class separate from those occurring on passenger trains; it would be well if the totals of these two classes were shown in the Bulletins separately. Comparisons with the annual accident records of England are becoming quite common nowadays; but we can never expect to make a fair showing in such a comparison as long as we carry such large numbers of passengers in cabooses and freight cars.

The collision at Berea, Ohio, due to the mistake of an operator or signalman, was one of a class that is not to be prevented by the use of automatic signals or "lock-and-block," for one of the trains was running west on the eastbound track of a double-track road. Such irregular movements are, of course, absolutely necessary now and then; and yet no one would think of providing a full equipment of electrical safeguards for movements in both directions on both tracks.

Item *e* in the list is made prominent only because two derailments occurred in consequence of a single rail failure. Items *d*, *e* and *h* represent three serious accidents in the same locality.

The number of electric car accidents reported in the newspapers in February was 11, in which 10 persons were killed and 62 were injured. Nine of the 10 deaths are chargeable to a single accident at Newark, N. J., on the 19th, where a street car which became uncontrollable on a descending grade collided with a locomotive. The tenth was due to a butting collision on an interurban electric railroad (Peoria, Ill.) due to a combination of fog and a mistake in giving or reading orders. In the Newark case the Coroner's jury, which considered the matter two weeks, rendered a verdict finding, among other things, as follows:

"The trolley car was not controlled by the motorman's brakes, broke through the railroad gates and came into collision with the passenger train. We find among the officials and employees a disregard of their several duties, a systematic shifting of responsibility from one to another and a lack of thoroughness and care. . . . The tracks at the grade at Clifton avenue, on the morning of the accident, were covered with ice and snow to the depth of two or more inches. No trace of salt or sand could be found. The sand provided for that purpose was found frozen in the box, and could not be used. We also find this trolley car to have been heavily overloaded. There were eight, and probably ten, passengers on the front platform at the time of the collision. . . . It is fair to presume that had the rules of the company prohibiting the use of the front platform been enforced no deaths would have occurred in this collision.

"We find further that the trolley company failed to install a derailing appliance. The general manager gave as the reason for failing to adopt such device that they were prevented by the Delaware, Lackawanna & Western Railroad Company; but we find such a device has been acceptably used at the Bloomfield avenue crossing of the same railroad in Montclair, and for this reason we cannot accept the statement of the general manager as satisfactory for leaving unprotected for so long a time this dangerous crossing.

"We find the employees of the trolley company were continually disregarding the rules and regulations that were prepared for their guidance and that the infraction of these rules was clearly known to the head officials. . . . For these reasons we find that the North Jersey Street Railway Company is guilty of gross negligence in the performance of duty as common carriers. . . . We find the Delaware, Lackawanna & Western Railroad Company are violating the city ordinance by running their trains at a much higher rate of speed within the city limits than is permitted by the ordinances; also for not stopping all trains at the Broad street crossing, all of which are in violations of such ordinances. But we feel that these violations cannot be held as in any measure contributing directly to this dreadful disaster.

"We find, further, that the Board of Street and Water Commissioners and the Police Department, whose duty it is to care for the safety of the public and the interests of the city, have not performed their whole duty. . . ."

TRADE CATALOGUES.

The American Locomotive Company has just issued a handsome catalogue for foreign distribution, describing a few locomotives recently built for use in this and foreign countries. A short description of the organization and present and prospective facilities of the constituent works of the American Locomotive Company is given, and it is stated that another catalogue is now in preparation that will treat at greater length their products and facilities. The combined plants cover over 200 acres of land, comprising 127 buildings, with a total of over 17,000 employees. These plants have built 27,800 locomotives up to date, and when improvements now under way are completed the combined annual capacity will be about 342,000 tons. The front cover page of the catalogue is embossed in silver and black with a picture of the Empire State Express, which is pulled by an Atlantic-type locomotive built by this company.

Across the Continent is the title of the latest Union Pacific "scenic guide." The book illustrates a trip from the Missouri River to the North Pacific Coast over the Union Pacific, Oregon Short Line and Oregon Railroad & Navigation Co. The frontispiece shows the "oldest inhabitant" of Union Pacific territory—the buffalo. The pages have half-tone engravings from photographs, showing views of 20 important cities along the route, and the interesting scenes in the country traversed.

Slotting Machines.—The Betts Machine Co., Wilmington, Del., has sent out its catalogue No. 14, in which are described the various forms and sizes of slotting machines made by this company. These machines are massive and strong and at the same time simple and easy to operate. They are made in sizes from 8 in. up to 24 in. stroke with adjustments for any position and length of movement, and are adapted for individual motor drive.

The Robinson Exhaust Nozzle is the title of a little pamphlet sent out by the Economy Car Heating Company, Portland, Me. It describes this nozzle as being so designed as to produce a uniform and continuous low vacuum; with more perfect and steady combustion of fuel; less noise and a reduction in the volume of black smoke discharged.

Train Accidents in the United States in February.[1]

dr, 1st, 6 p.m., Northern Pacific, Forest River, N. Dak., passenger train No. 8 was derailed by a broken rail and the baggage car was badly damaged.

†dn, 1st, Alabama & Vicksburg, Vicksburg, Miss., two cars of a freight train broke away and ran down the incline into the Mississippi River. In one of the cars, containing emigrant's movables, there were the emigrant and five of his family, all of whom were drowned.

rc, 2d, Southern Pacific, Bealville, Cal., an empty engine of the Atchison, Topeka & Santa Fe ran into the rear of a preceding Southern Pacific freight train. The conductor and one other man were injured.

xc, 3d, Baltimore & Ohio, Easton, Ohio, a work train collided with a caboose and some freight cars which had broken away from a preceding freight train and had run back down hill, and a bad wreck resulted. One trainman was killed, being burned to death, and another was fatally injured. These men had been sleeping in the caboose.

xc, 4th, Mobile & Ohio, Meridian, Miss., collision of locomotives; three employees injured, one of them fatally.

*rc, 5th, 2 a.m., El Paso & Northeastern, Tecolote, N. Mex., rear collision of freight trains, wrecking the caboose and seven cars. The caboose and two cars took fire and were burnt up. Three trainmen were killed and a fourth was fatally injured.

unx, 8th, Gulf, Colorado & Santa Fe, Concord, Texas, a freight train was derailed and the engine was overturned. The engineman and fireman were injured, the latter fatally.

bc, 9th, Southern Railway, Jackson, Ga., butting collision between a southbound passenger train and a northbound freight; 14 passengers injured.

9th, 11 p.m., Pittsburgh, Fort Wayne & Chicago, Alliance, Ohio, westbound passenger train No. 405 collided with an empty engine near the station, pushing the engine forward and into a passenger train standing at the station. The empty engine was badly damaged and its engineman and fireman were injured.

dr, 9th, Union Pacific, Echo, Utah, westbound passenger train No. 1 was derailed by a broken rail and all of the cars were ditched.

unx, 9th, Canadian Pacific, Greenville Junction, Me., an eastbound passenger train was derailed and the engine was overturned. The engineman and fireman were injured, the former fatally.

unf, 10th, Atlanta, Knoxville & Northern, Madisonville, Tenn., a freight train was derailed by a land slide and the engine and several cars were badly damaged. A brakeman was killed and the engineman and fireman were injured.

unx, 10th, 11 p. m., Quincy, Omaha & Kansas City, Plattsburgh, Mo., a passenger train of the St. Joseph & Grand Island, running over this road, and running backwards, was derailed, the tender being the first vehicle to leave the track; and the engine was overturned. A boy stealing a ride was killed and three trainmen were injured.

xc, 11th, Chicago & North Western, Winnetka, Ill., collision between a passenger train and a freight, the freight being on the main track during a dense fog, without orders. Three trainmen and one passenger were injured.

xc, 11th, South Georgia Railroad, Barney, Ga., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, making a bad wreck. The fireman and one brakeman were killed.

unf, 11th, Northern Pacific, Mullan, Mont., a freight train while crossing a trestle bridge was overwhelmed by a snow slide and many of the cars, with seven bents of the bridge, were swept into the gulch many feet below. Five trainmen were injured, two of them probably fatally.

12th, Pittsburgh, Cincinnati, Chicago & St. Louis, Hamilton, Ohio, the engine of a freight train which had been stopped because of some disablement of its machinery was accidentally started by the disarrangement of the throttle valve, and ran at high speed several miles to and through Hamilton, and was finally derailed at a curve and ditched.

unf, 12th, 4 a.m., Southern Pacific, Gibson, Cal., several cars in a freight train were knocked off the track and badly crushed by a fall of earth from the roof of tunnel No. 9, which occurred just as the train was passing through. The front portion of the train, after running about four miles, was derailed and five cars fell down a bank. It is believed that the fall of earth was due to the

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

derailment of a car which ran against the side of the tunnel.

bc, 13th, 10 p.m., Seaboard Air Line, Pembroke, N. C., butting collision between a passenger train and an empty engine, the latter running tender first. In the collision the engine was detached from its tender and then ran forward about eight miles, when it died at the foot of a hill. The fireman of this engine was fatally injured in the collision. It is said that the empty engine had orders to proceed to Pembroke station to relieve the passenger train, the engine of which had been partly disabled, but the order was disregarded; the engine ran about one mile beyond the meeting place.

dr, 13th, 4 a.m., Southern Pacific, Icarus, Nev., the westbound overland limited passenger train, running at good speed, was derailed by a broken rail, though only the two rear cars went off the track; these two were dragged 600 ft. beyond the broken rail before they were stopped.

dr. A short time afterward the second section of the same train came on and was derailed at the same spot, its two engines and first three cars being overturned. It is said that the flagman of the first train had placed torpedoes to stop the second, but evidently without effect. The engineman of the second section was killed.

unf, 13th, Baltimore & Ohio, Vienna, Pa., a freight train was derailed by running into a land slide, and the engine and several cars were ditched. The engineman was killed and two other trainmen were injured.

bc, 14th, 11 p.m., Southern Railway, Rome, Ga., butting collision between passenger train No. 37 and a freight, badly damaging both engines and wrecking one mail car. The conductor was injured.

dr, 14th, Southern Pacific, Winnemucca, Nev., the eastbound overland limited express train was derailed by a broken rail and six cars were ditched. One trainman and one passenger were slightly injured. At the time of this accident the mercury stood at 15 deg. below zero.

rc, 15th, Lake Shore & Michigan Southern, Elkhart, Ind., an empty engine ran into the rear of a preceding freight train, wrecking the caboose and one car. The caboose took fire and was burnt up. The conductor and one brakeman were injured, the former fatally.

rc, 15th, 7 a.m., Pennsylvania Road, Allegrippus, Pa., an eastbound freight train, descending the steep grade at this point, became uncontrollable and ran into the rear of a preceding freight, wrecking one engine and 18 cars. Two trainmen were injured.

bc, 15th, 5 a.m., Cincinnati, New Orleans & Texas Pacific, Roddy, Tenn., butting collision between southbound passenger train No. 21 and a northbound freight. Both engines and the baggage cars were badly damaged and one engineman and one fireman were injured. It is said that the men in charge of the freight train had forgotten a telegraphic order.

unf, 15th, 2 a.m., Southern Railway, Ravensworth, Va., passenger train No. 23 was derailed at a misplaced switch and the engine and forward cars were badly wrecked. The engineman and fireman were killed and two postal clerks were injured. It is said that the switch had been maliciously misplaced and the lock and lamp carried off.

bc, 16th, Delaware, Lackawanna & Western, Phillipsburg, Pa., westbound passenger train No. 403 ran over a misplaced switch and into the head of an eastbound freight; three passengers and one trainman were injured. It is said that the engineman of the passenger train was running on this part of the road for the first time in five years.

xc, 16th, 6 a.m., Pennsylvania Road, Gallitzin, Pa., a freight train which had been stopped on an ascending grade and the two leading engines detached for the purpose of taking water, eluded control and ran back down the grade, in spite of efforts to hold it by means of an engine which was at the rear. The runaway train collided with a following freight, wrecking two engines and four cars. A brakeman was injured, probably fatally.

eq, 16th, Charleston & Western Carolina, Madden, S. C., a freight train was derailed by a drawbar which was pulled out and fell to the ground. Two trainmen were injured.

dn, 18th, Cincinnati, Hamilton & Dayton, Piqua, Ohio, a freight train was derailed at the derailing switch approaching the crossing of the P., C., C. & St. L., and the engine was ditched. The engineman was injured.

3nx, 18th, Erie Road, Sharpsville, Pa., westbound passenger train No. 7 was derailed, from some cause not yet determined, and the engine fell down a bank and was overturned. The two cars next the engine fell part way down. The engineman was killed.

o, 19th, Philadelphia & Reading, Pottsville Junction, Pa., the locomotive of a passenger train was wrecked by the explosion of its boiler, and the fireman was killed. The engineman and one passenger were injured, the former fatally. It is said that the injector of the engine had been frozen and that the explosion occurred immediately after it had been thawed out.

bc, 20th, Illinois Central, Galena, Ill., butting collision between a northbound passenger train and a southbound freight, wrecking both locomotives and the forward cars of both trains. Three trainmen were killed and a fourth was fatally injured. It is said that the freight, which had been waiting on the side track some time for the passenger, was run out on to the main track for the purpose of taking water, with the intention of retreating before the passenger train arrived.

xc, 21st, Denver & Rio Grande, Marshall Pass, Colo., a freight train broke in two and the rear portion afterwards ran into the forward one. The fireman and one brakeman were killed.

xc, 22nd, 5 a.m., Baltimore & Ohio, Connellsville, Pa., passenger train No. 9 ran into the rear of a preceding freight in consequence, it is said, of a wrong block signal indication; and the engine, caboose and three cars were badly damaged. Three trainmen were injured.

*23d, Cleveland, Cincinnati, Chicago & St. Louis, Berea, Ohio, butting collision between a westbound passenger train and an eastbound freight, wrecking both engines, two mail cars and parts of many other cars, including two cars of cattle. A fire started in one of the mail cars and all of the cars in the passenger train except two were burnt up. A number of freight cars were also destroyed by fire. Four mail clerks and four men supposed to be tramps were burned to death. It is said that the freight train started out from a side track without proper authority. The passenger train was, by special order, running west on the eastbound track.

†unx, 23d, Chicago & North Western, Athol, S. Dak., a passenger train was derailed and the cars were ditched. One passenger was killed and eight were injured.

24th, Pennsylvania Lines, Larwill, Ind., collision of freight trains; one brakeman killed.

rc, 25th, Pennsylvania road, Kittanning Point, Pa., a freight train which had become uncontrollable on the steep descending grade at this point ran into the rear of a preceding freight, wrecking 30 cars. One brakeman was killed and five other trainmen were injured, one of them fatally.

xc, 27th, Pennsylvania Road, Spruce Creek, Pa., rear collision of freight trains; three trainmen injured.

dn, 27th, Philadelphia, Baltimore & Washington, Havre de Grace, Md., the engine of a freight train ran into the open draw at the Susquehanna River and, with two cars, fell to the stream below.

*†28th, 2 a.m., Cincinnati, New Orleans & Texas Pacific, Lenoir City, Tenn., a passenger train was derailed by a land slide and the engine fell down a bank. Several passenger cars were thrown off the track. Some of them fell down the bank and three of them took fire and were burnt up; one passenger and five trainmen were killed.

28th, 8 p.m., New York Central & Hudson River, Dewitt, N. Y., the caboose of a freight train was derailed and fell on an adjacent track immediately in front of a westbound passenger train. The passenger train was running at high speed and its engine was overturned and wrecked. All, or nearly all, of the cars were derailed, and those in the front end of the train were badly damaged. Three trainmen in the caboose were killed and the engineman, fireman and one other trainman on the passenger train were injured.

TECHNICAL.

Manufacturing and Business.

The Nernst Lamp Company, of Pittsburg, Pa., has opened an office in the National Life Building, Chicago.

The Peters Signal Co., of Knox, Md., has been incorporated with $100,000 capital, to make the Peters railroad signal.

The American Engineering & Foundry Co. has been incorporated at Los Angeles, Cal., with $100,000 capital. Alpheus Redmond is an incorporator.

Dodge & Day, modernizing engineers, of Philadelphia, have been commissioned to report on motor equipment for the Firth-Sterling Steel Company, of Pittsburg.

F. G. Whipple, formerly Chief Draftsman for the American Steel Foundry Co., St. Louis, Mo., has become salesman, in Chicago, for the Crocker-Wheeler Company.

The Helwig Mfg. Co., St. Paul, Minn., has added to its line of reversible pneumatic motors a No. 2 end spindle for metal work; also a reversible wood boring motor and end spindle.

The American Hoist & Derrick Co., St. Paul, Minn., maker of hoists, derricks, cranes, hoisting engines, etc., will build an addition to its erecting shop, and will later increase the facilities of the foundry and boiler shops, to provide for increased business.

The Stanley Electric Mfg. Co., through its Montana office, has sold to the Bismarck Nugget Gulch Consolidated Mining Co., a complete equipment consisting of inductor alternators, induction motors, hot wire voltmeters, lightning arresters, and the attendant controlling and regulating apparatus.

Frank L. Davies, Chief Clerk of the Motive Power & Machinery Department of the Chicago & Eastern Illinois, has formed a partnership at Danville, Ill., with Chas. F. Perkins, of the Bridge and Building Department of the same road, under the firm name of Davies & Perkins, to engage in general contracting, concrete masonry, bridge work, excavations and foundations.

The Sterlingworth Railway Supply Company has expended, during the past four months, about $60,000 in improvements to their rolling mill department, consisting of gas convertors, a 100 ton gas furnace, 800 additional h.p. Berry boilers, and 1,200 h.p. Corliss rolling mill engine, and a full equipment of steel rolls for the manufacture of angles, I-beams and channels up to 15 in.

The Wyckoff Pipe & Creosoting Co. has recently enlarged its works at Portsmouth, Va., and consolidated the plants formerly at Norfolk, Va., and at Williamsport, Pa. The company has gone extensively into the work of creosoting railroad ties and is able to handle a large quantity at once. Its creosoted wooden conduits for underground telephone and telegraph wires have been in use for over 12 years. The general office is Stamford, Conn.

The New York Continental Jewell Filtration Co. has recently received a filter contract from Cornell University, and also a contract for the entire city supply at Ithaca; also a large contract from the Producers' Powder Co., of Ashburn, Mo., for a New York gravity type of filter. A plant was recently installed by this company at Chester, S. C., and the tests were very satisfactory. The water before passing into the filter was highly colored by a clay solution, and this coloring was entirely removed by the filter.

Willis S. Jones, General Manager of the Railroad Supply Company, Chicago, has been requested by the Ferrocarriles Unidos de Yucatan to visit Merida and look over the ground and make plans and specifications for the terminal yards, union station and shops to be built at this point. A year ago Mr. Jones visited Mexico on a similar errand, and made the plans for the railroad terminals at the port of Vera Cruz, and also for the railroad terminals of the National Tehuantepec line at both Coatzacoalcos and Salina Cruz. Mr. Jones was formerly Chief Engineer of what is now the Chicago Terminal Transfer R. R. He made the location for the line and designed all of the yards and terminals, both dock and freight. He also made the general plans of the union passenger station and facilities at the corner of Harrison street and Fifth avenue, and had entire charge of the construction work of the road during a period of seven years.

Iron and Steel.

The Aurora Foundry & Machine Co., Aurora, Mo., has been incorporated with a capital of $75,000.

The Steel Corporation of Canada has applied to the Parliament of Canada to be incorporated with $1,000,000 capital, for the manufacture of steel rails, bridge material, etc.

The Baxter Rail Joint Co., capital $10,000, has been incorporated at Richmond, Va. Gifford B. Lewis, of Richmond, is named as President of the company, and German L. Baxter, of Lexington, Vice-President.

United States Steel Output.

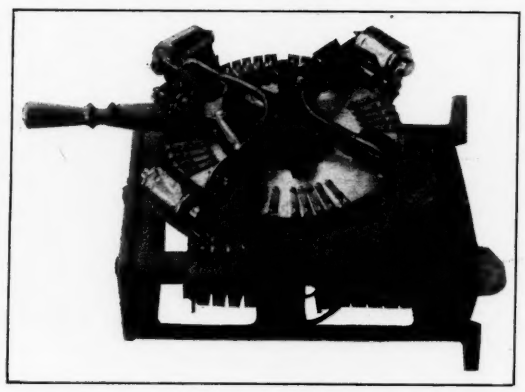
According to an estimate given in the *Wall Street Journal*, the United States Steel Corporation, at the close of the third year's business on March 31, had unfilled orders on its books to the amount of 7,000,000 tons, which is more than its total output during its first year, and over half its production in 1902. An estimate of the sources of demand for iron and steel, based on the orders now booked, shows the following proportionate uses of the finished product: For railroad uses, rails, locomotives, rolling stocks, repairs, etc., 45 per cent.; skyscrapers and buildings, bridge work, etc., structural steel and girdle iron, 20 per cent.; electric street railroads, equipment and rails, 7 per cent.; cast-iron pipe, 8 per cent.; agricultural implements and farming machinery, 6 per cent.; miscellaneous, including electrical works, ware manufacture, etc., 14 per cent.

Bituminous Coal Production.

The *Coal Trade Journal* has published a diagram showing the production of bituminous coal in the United States by years, since 1840, and also giving the amount produced in each of the most important coal States in recent years. The current figure for bituminous coal is 280,000,000 tons, as against 164,000,000 tons in 1898, and 45,000,000, in 1880. During 1902, Pennsylvania mined 96,643,904 tons, an increase of nearly 14,000,000 from the previous year. Illinois, with 30,000,000 tons, is second in the list, and West Virginia, with 25,500,000, third.

Controller For Direct Current Motors.

For the control of d.c. motors operating cranes, hoists, etc., and similar appliances requiring variations in speed and frequent stops and reversals, the Westinghouse Electric & Mfg. Co. has placed upon the market an improved controller of the commutator type which has been designed especially for this class of work. The necessary resistance is mounted inside of a cast-iron frame, on the outside of which is attached the commutator, or contact dial, for regulating the resistance and for reversing the motor. Ventilated cell resistance is used in the smaller sizes as shown. The resistance in the larger sizes consists of cast-iron grids.



The contact dial is made of copper fastened to the periphery of a circular stone. The contacts are simple and may be easily renewed. The brush-holder is fitted with four contact arms, which, when the circuit is opened, divide the arc into four breaks. Each contact arm has a blow-out magnet which reduces the arcing to a minimum.

THE SCRAP HEAP.

Notes.

The Legislature of Texas has passed a law requiring railroads to have lights on all switches.

Shipments of flour from Minneapolis to the Pacific Coast for Australia are said to be going forward now at the rate of 30 carloads a day.

A general passenger agent at St. Paul says that the number of home seekers going West in excursions this year is greater than ever before.

Press despatches from Chicago this week appear to indicate that not all of the embargoes on eastbound freight were removed until March 25.

The Chicago Great Western has nearly ready for use a telephone line connecting its three termini, Chicago, St. Paul and Kansas City. A heavy copper wire will be used exclusively for the telephones.

The "Golden State Limited" train of the Rock Island road will hereafter run twice a week each way, instead of daily; leaving Chicago Thursdays and Saturdays and Los Angeles Mondays and Fridays.

It is announced that the "Pennsylvania Special" 20-hour train between New York and Chicago, which was taken off on the 5th of February in consequence of the freight congestion, is to be restored on May 3.

The Atchison, Topeka & Santa Fe has been using, on an officers' train, a telephone between the engine and the officers' car. The receiving telephone is made small enough to be covered by the hand while held to the ear. Dry batteries are used.

The Philadelphia & Reading has sued the American Bridge Company for $13,550 demurrage on freight cars.

It appears that the railroad had a special contract with A. & P. Roberts, now a part of the American Bridge Company, by which the bills for demurrage should be made on the 24-hour average; the charge (of $1 a day) was not to be made unless the detention of all of the cars for the calendar month averaged more than 24 hours each. The cause of the dispute does not appear in the published accounts.

The crevasses in the levees along the Mississippi River have become so large as to threaten the most extensive destruction from water that has occurred in Louisiana in many years. At the Hymel Plantation, 40 miles above New Orleans, a crevasse which is now beyond control permits the inundation of several hundred square miles, and the estimates of losses to planters, business men and railroads rise to many millions of dollars. The Texas & Pacific track, two miles from the river, is covered with from 3 ft. to 8 ft. of water for several miles. There is a crevasse a mile wide near Greenville, Miss.

It is announced that the Erie Railroad has agreed to advance the wages of locomotive enginemen, but nothing definite is given out as to the percentage of increase. The Atlantic Coast Line has increased the pay of enginemen and firemen. The New York, New Haven & Hartford will increase on May 2 the wages of car builders, firemen, freight handlers and shopmen. It is said that this increase will be about 10 per cent. Negotiations between the trainmen of the company and the officers have not at this writing been finished. The Cincinnati, Hamilton & Dayton has increased the pay of telegraph operators about 9 per cent.

The State Railroad Commissioners of Massachusetts have ordered the New York, New Haven & Hartford to reduce certain short-distance passenger fares to and from Boston. After the reduction of the fares for two or three short trips to 5 cents, certain other fares for a little longer distance were at once complained of and, after a hearing the commission ordered these larger fares reduced also; but this was found to produce so large a substantial diminution in the annual receipts of the company that the road did not comply with the order. Recognizing that if the new rates cause a loss of net earnings the proposed change should be made only after a test, it is now ordered that the test be made by making the reduction on the first of May, which is the beginning of the season for active competition between steam and street railroads.

At Newark, N. J., March 26, the Essex County Grand Jury indicted the members of the Executive Committee of the Board of Directors of the North Jersey Street Railroad for manslaughter, charging each with responsibility for the death of the nine passengers in the street car which was wrecked on Feb. 19 by colliding with a locomotive at a crossing of the Delaware, Lackawanna & Western. Among the directors thus indicted are Andrew J. Cassatt, President of the Pennsylvania Railroad; John D. Crimmins, of New York; J. Roosevelt Shanley, of Newark; Dr. Leslie D. Ward, Vice-President of the Prudential Insurance Company, of Newark, and Elisha B. Gaddis, wholesale grocer, of Newark. The accused pleaded not guilty and were held in $2,000 bonds each for appearance before the Court at a future date, probably in the month of May.

The Erie Canal Bill.

The Senate of New York State on March 24 passed Senator Davis's bill for a 1,000-ton barge canal along the line of the Erie, Oswego and Champlain Canals, to cost $101,000,000. It is proposed to build a canal 12 ft. deep, which will follow in general the lines of the Oswego and Champlain Canals and the line of the Erie Canal in the western part of the State, although it will not follow it so closely in the eastern part of the State. Before the plan can become a law it must go before the House of Representatives, and it must also be submitted to the vote of the people of the State at the election next November.

New Battleships.

Bids are now being asked by the Navy Department for the construction of three of the five battleships authorized at the last session of Congress. The vessels, as reported in our issue of March 20, page 217, will be 16,000 tons displacement, with a speed of 18 knots. The length of water line will be 450 ft.; breadth, 46 ft. 10 in.; draft to bottom of keel, 24 ft. 6 in., and total bunker capacity, 2,200 tons. The maximum time for building each of the vessels is fixed at 42 months, but preference will be given to bids which guarantee completion in a shorter space of time. The equipment will consist of 24 guns of large calibre in the main batteries, and 70 guns of various calibres in the secondary batteries. The engines will be of the vertical twin-screw, four-cylinder, triple-expansion type, with a combination indicated horse-power of 16,500.

I. C. C. Order Concerning Free Cartage.

The Interstate Commerce Commission has promulgated an order requiring common carriers subject to the Act to regulate commerce to publish in their rate sheets what, if any, cartage or other kind of terminal service they provide or allow. After reciting the requirement in the law and calling attention to the provision in the recent Elkins bill imposing penalties for failure to publish and file tariffs, etc., the order states that concessions or advantages to shippers or consignees which affect the aggregate charge to the shipper are plainly afforded by free cartage and cartage allowances, unless such allowance is specified in the published tariffs. Carriers are required to plainly indicate what, if any, cartage or other kind of terminal service they provide, specifying the nature and extent of such service, the places where given, and what, if any, charge or allowance is made therefor.

An Empire State Express Run.

On March 24 the Empire State Express train, No. 51, of the New York Central, was delayed 10 minutes on the Hudson Division, and when released it made the run from Rhinecliff to Rensselaer, 53 miles, in 45 minutes, arriving at Rensselaer on time. The rate of speed from Rhinecliff to Hudson was 66 miles an hour, and from Hudson to Rensselaer 76 miles an hour; average speed for the entire 53 miles, 71 miles an hour. This run was made with the regular train, hauled by engine No. 2924. This record comes pretty close to the records on the Atlantic City Railroad, Camden, N. J., to Atlantic City, 55.5 miles. The best Atlantic City record is 44 minutes, 45 seconds, with six cars. The grades and alignment are probably easier than from Rhinecliff to Rensselaer.

Locomotive Classification.

The American Locomotive Company has recently adopted the Whyte classification for distinguishing the several types of locomotives. This system was suggested by Mr. F. M. Whyte, Mechanical Engineer of the New York Central at the 1901 meeting of the American Railway Master Mechanics Association.

This classification is based on the representation by numerals of the number and arrangement of the wheels, commencing at the front truck. Thus, 260 means a mogul which, as is known, has a two-wheel leading truck, six drivers and no trailing truck. Again, a prairie-type engine would be represented by 262, which means a two-wheel leading truck, six drivers and a two-wheel trailing truck. Similarly, the Atlantic-type would be 442.

The total weight is expressed in thousands of pounds. Thus, an Atlantic-type locomotive weighing 176,000 lbs. would be classified as a 442-176 type. If the engine is compound the letter C would be substituted for the dash, thus, 442-C-176. If tanks are used in place of a separate tender the letter T would be used in place of the dash. A double-end suburban locomotive with two-wheel leading truck, six drivers and a six-wheel rear truck, such as is used by the New York Central, and weighing 214,000 lbs., would be a 266-T-214 type.

Interstate Commerce Law Interpreted.

At the request of a Chicago traffic official the Interstate Commerce Commission has given its views on the law as below: The Commission declares that it is reluctant to answer hypothetical questions and to give ex parte opinions as to the meaning and application of laws, but that the present case is one in which the traffic men should be well informed. Taking up the specific questions the Commission says:

(1.) We are of the opinion that free or reduced transportation given "on account of a shipper's business or to influence that business, which is the same thing, would be a rebate, concession, or discrimination" under the Elkins bill.

(2.) It would be a violation of the law to perform the shippers' drayage without providing for it in the tariffs, or to perform it for one and not for another.

(3.) It is not believed that the payment of a reasonable commission for soliciting freights or for sale of tickets can be held to be a rebate, if the transaction is an honest one.

(4.) It is difficult to see how the practice of charging lower rates to those who are establishing new industries than are charged at the same time to shippers of the same articles between the same points can be excepted from the operations and obligations of the law, however unobjectionable such a practice may be from a railroad and general economic standpoint.

(5). We prefer not to express an opinion at this time as to whether railroads may lawfully transport supplies for each other at reduced rates. . . .

(7.) The first section of the Elkins bill appears to refer exclusively to the transportation of property. The third section, investing the circuit courts with additional jurisdiction, covers both property and passengers.

Will Good Times Hold for a While?

Mr. J. P. Morgan, who rarely talks for publication, makes, through the New York *Times*, this prophecy:

"It seems to me that the general pessimistic talk indulged in not alone in foreign but in local circles is in no sense justified by the facts. It may be true, as some of the captious critics declare, that at the present moment there are in the market many undigested securities, but ought not the character of these securities to be taken into consideration in a broad or comprehensive view of the situation? Are these securities sound or are they unsound; do they represent value or do they not; for what purposes have they been issued—those are the questions.

"To my mind and in my judgment these new securities are essentially sound and stable, and those who have them are in no wise alarmed because of their holdings. Beyond all this, they are issued not to build competing lines but largely for the purchase of rolling stock and motive power and for the extension of other facilities necessitated by the necessary movement of the products of the country.

"You will find that in due time this phase of the difficulty—growing out of these new securities—will disappear.

"As for the general situation you may state emphatically and unequivocally that it is most promising, with the country unqualifiedly prosperous. In the iron and steel trade, for example—the barometer of the country's growth, stability, and business activity, there never was so great or so profitable business. Orders on hand run far ahead and the outlook is decidedly encouraging.

"In short, summing the situation up, not only is there prosperity everywhere, but the promises are of a continuation of that prosperity for a long time to come."

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Car Foremen's Association of Chicago.

The regular meeting of the Association will be held in room 209, Masonic Temple, Chicago, April 8, at 8 p.m.

Western Society of Engineers.

At the regular meeting in Chicago March 27, Prof. C. S. Slichter gave an address on "The Measurement of Underflow Streams in Southern California."

Engineers' Club of Philadelphia.

A business meeting will be held on April 4, at 8 p.m. Mr. L. Y. Schermerhorn will read a short paper on "The Obstruction of the Navigation of Southern Rivers by the Growth of the Water Hyacinth," and Dr. E. K. Landis will read a paper on "The Richards Prismatic Stadia Used as a Range Finder."

American Society of Civil Engineers.

At the meeting on April 1 papers were presented for discussion as follows: "The Filtration Works of the East Jersey Water Company, at Little Falls, N. J.," by George W. Fuller, Assoc. M. Am. Soc. C. E., and "Automatic Modules for Regulating the Speed of Filtration," by Charles Anthony, M. Am. Soc. C. E. These papers were printed in the *Proceedings* for February, 1903.

American Railway Association.

The spring session of this Association will be held at the Waldorf-Astoria, New York city, on April 22. Reports will be presented by the Executive Committee and the Committees on Train Rules, on Car Service, on Safety Appliances, on Standard Dimensions of Box Cars, on Statistical Inquiry, and on Standard Cipher Code. The annual election of officers, a President and two Vice-Presidents, will take place at this meeting.

Engineering Association of the South.

At the March meeting held in Nashville, Tenn., on the 12th, Mr. C. W. Richardson read a paper on "The Thermal Springs of the Virginia Mountains," and Prof. C. S. Brown, of Vanderbilt University, gave a talk on "Steam Distribution in the High-Speed Automatic Engine," illustrated by a series of models of the governor mechanisms used on this type of engine. Prof. Wm. W. Carson resigned as president of the Association, and his successor will be elected at the April meeting.

PERSONAL.

—Mr. S. H. Mallory, a prominent railroad contractor of the west, died at his home in Chariton, Iowa, March 26.

—Mr. William Davis, a well-known railroad man, died at his home in San Antonio, Texas, March 23, aged 66 years.

—Mr. W. H. Whalen, for some time past Purchasing Agent of the Delaware, Lackawanna & Western, has resigned, to accept a position with the Peerless Rubber Manufacturing Company of New York.

—Mr. Francis C. Faulkner, a member of the New Hampshire State Railroad Commission, died suddenly at his home in Keene, N. H., March 26. Mr. Faulkner was about 51 years old and was a graduate of Harvard University.

—Mr. G. A. Bowers, the new Master Mechanic of the Southern Railway at Alexandria, Va., was born at Martinsburg, W. Va., in 1867. After graduating from the High School in that city in 1883 he went to the Baltimore & Ohio as machinist apprentice. From 1887 to 1892 he was journeyman machinist. He was then made night foreman at Martinsburg, but in 1895 he resigned to go with the Western Maryland at Union Bridge. The following year he was made night foreman at Hagerstown, Md., and in 1897 became General Roundhouse Foreman. For a time Mr. Bowers was Assistant Chief Engineer at the Maryland University Hospital, Baltimore, but later returned to the Baltimore & Ohio and was subsequently on the Baltimore & Annapolis Short Lines and the Annapolis, Washington & Baltimore as Master Mechanic at Annapolis.

—Mr. H. A. Williams, the new Superintendent of the Norfolk Division of the Southern Railway, was born in 1861 at Williamston, S. C., and began work as a messenger with the Columbia & Greenville at Hodges in 1874. For two years he was a brakeman, then freight conductor, and in 1887 he became yardmaster at Colum-

bia. In 1890 he was made Trainmaster, but resigned in 1894 to go to the Florida Central & Peninsular. Two years later he went to the Southern as Trainmaster; was transferred to the main line in 1900, and in March last was promoted to be Superintendent at Lawrenceville, Va.

—Mr. George Morton, who has succeeded the late Mr. Barker as General Passenger Agent of the Missouri, Kansas & Texas, was born at Newport, Ky., in 1866. In 1886 Mr. Morton entered railroad service as a clerk with the Kentucky Central, and the same year was made Chief Clerk of the passenger department under Mr. S. F. B. Morse. In 1890 this company was sold to the Louisville & Nashville, and Mr. Morton was transferred to the General Passenger Agent's office. In 1894 he was made rate clerk for the Missouri, Kansas & Texas, and in 1897 became Chief Clerk, which position he has held until now.

—Mr. W. C. Loree, Mr. Rawn's successor as General Superintendent of the Pittsburgh Division of the Baltimore & Ohio, was for several years with the Pittsburgh, Cincinnati, Chicago & St. Louis. He is 43 years old, and his railroad service dates from 1883, when he began as a rodman on the Chicago, St. Louis & Pittsburgh. During the year 1886-'87 he was in the engineering department on the construction of the Cincinnati & Richmond. For two years he was Assistant Engineer of the Little Miami Division of the Pittsburgh, Cincinnati & St. Louis. In 1889 Mr. Loree was made Engineer of Maintenance of Way of the Pittsburgh, Cincinnati, Chicago & St. Louis, and remained with this company until he went to the Baltimore & Ohio in 1902. Mr. Loree was Superintendent of the Chicago Division before this last promotion.

—The new Mechanical Engineer of the Chicago & North Western, Mr. W. E. Dunham, began his railroad service in the shops of the Chicago, Rock Island & Pacific, at Horton, Kan. In October, 1898, he went to the Chicago shops as a draughtsman, and left in 1901 to go to the Chicago, Rock Island & Mexico and the Chicago, Rock Island & El Paso as Master Mechanic, at Dalhart, Texas. The next year he went back to the Rock Island and in October of that year (1902) became Chief Draughtsman for the Chicago & North Western, at Chicago. In March last he was made Mechanical Engineer to succeed Mr. Thompson.

—Mr. Arthur M. Waitt resigned on April 1 his office as Superintendent of Motive Power and Rolling Stock of the New York Central & Hudson River Railroad, where he has served for about four years. We do not know what Mr. Waitt is going to do but imagine that he will rest a while, for he has fairly earned rest. He is a type of the successful railroad officer whose natural ability was developed and made available earlier in life than it would have been if he had not had the advantage of preliminary thorough education. He was born in Boston in 1858, graduated at the Massachusetts Institute of Technology in 1879, and went to work as a clerk for the Chicago, Burlington & Quincy at Burlington, Iowa. He was soon transferred to the Aurora shops, but his bad health forced him to quit indoor work. For some time he was a salesman and general agent for the Van Liew grain door. This cheerful employment apparently cured him and he became a draughtsman for the Eastern Railroad, and for two years was chief draughtsman. He became General Foreman and then Assistant Master Car Builder for the Boston & Maine. In 1889 he was made Assistant Manager of the car works at Pullman, Ill., and this place he resigned to become Assistant General Master Car Builder of the Lake Shore Railroad, with headquarters at Cleveland. From 1892 to '99 he was General Master Car Builder of the Lake Shore; since then he has been with the New York Central. Mr. Waitt has had honors and he has earned them. He is a Past-President of the American Railway Master Mechanics' Association, of the Western Railway Club, and of the Central Railway Club of Buffalo. He is Vice-President of the American Society of Mechanical Engineers, of the New York Railroad Club, and a member of the Engineers' Club, the Transportation Club and the Ardsley Club of New York city. Although Mr. Waitt now seeks retirement and rest it is not reasonable to expect that it will be long continued. He is still young and is a man of power and ability with a capacity for great usefulness.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—W. C. Loree has been appointed General Superintendent of the Pittsburgh Division, with headquarters at Pittsburg, Pa., succeeding I. G. Rawn, resigned. T. J. Foley, heretofore Assistant to the General Manager at Baltimore, has been appointed to succeed Mr. Loree as Superintendent of the Chicago Division, with headquarters at Chicago.

Chicago Great Western.—R. M. Crosby has been appointed Master Mechanic at Oelwein, Iowa, and J. E. Chisholm succeeds Mr. Crosby as General Shop Foreman.

Chicago, Rock Island & Pacific.—R. Williams, General Superintendent of the Northern District, with headquarters at Cedar Rapids, Iowa, has resigned. Frank Nay, heretofore Auditor of the Minneapolis & St. Louis, has been appointed Auditor of the C., R. I. & P., with headquarters at Chicago.

See Delaware, Lackawanna & Western.

Chicago, St. Paul, Minneapolis & Omaha.—F. E. Nicoles has been appointed Assistant Superintendent of the Wisconsin Division, with headquarters at Itasca, Wis., succeeding William Bennett.

Colorado & Southern.—W. A. George has been appointed Acting Superintendent of Motive Power and Car Department, with headquarters at Denver, succeeding Thomas Paxton, Superintendent of Motive Power and Car Department, resigned. J. H. Rathbone succeeds Mr. George as Master Mechanic at Denver.

Dayton, Lebanon & Cincinnati.—C. A. Alderman has been elected Vice-President, succeeding F. J. Green, resigned.

Delaware, Lackawanna & Western.—George F. Wilson, heretofore Superintendent of Motive Power of the Chicago, Rock Island & Pacific, has been appointed Purchasing Agent of the D., L. & W., with headquarters at New York city, succeeding W. H. Whalen, resigned, effective April 1.

Erie.—J. F. Maguire, heretofore Assistant General Superintendent of Transportation, has been appointed Superintendent of Transportation, succeeding George Van Keuren, General Superintendent of Transportation, transferred. H. B. Hunt, heretofore Mechanical Engineer, has been appointed Assistant to the General Manager, effective April 1.

D. W. Rigoney has been appointed Assistant Auditor of this company and the New York, Susquehanna & Western, and C. P. Crawford becomes Auditor of Disbursements, succeeding Mr. Bigoney, effective April 1.

Great Northern.—J. C. Patterson has been appointed Principal Assistant Engineer, with headquarters at St. Paul, and W. P. Whitten succeeds Mr. Patterson as Resident Engineer at St. Paul.

Gulf, Beaumont & Kansas City.—J. E. Baxter has been appointed Auditor, with headquarters at Beaumont, Texas, succeeding G. B. Gallon, resigned.

Indianapolis Union.—J. E. Merion has been appointed Auditor, with headquarters at Indianapolis, Ind., succeeding C. A. Vinnedge, resigned. (See Terminal R. R. Association of St. Louis.)

Lake Erie & Western.—R. M. Case, Assistant General Passenger Agent, with headquarters at Indianapolis, Ind., has resigned and that position has been abolished.

Lake Shore & Michigan Southern.—J. T. Burrows, heretofore Assistant General Baggage Agent, has been appointed General Baggage Agent, with headquarters at Cleveland, succeeding the late Mr. Freeman.

Lehigh Valley.—I. McQuilkin, Comptroller, with office at Philadelphia, Pa., has resigned.

Merchants Despatch Transportation Co.—R. H. Parks has been appointed Manager of the Car Shops, with office at Despatch, Monroe County, N. Y. The position of Master Car Builder has been abolished.

Mexican Great Eastern.—At a meeting held recently, H. H. Sypher, of Philadelphia, was elected Chairman of the Board; Jos. Hansen, President at St. Joseph, Mo., and Thomas Donahue, Assistant Secretary and Treasurer at Kansas City, Kan. The General Manager, W. G. Seaver, will also act as Purchasing Agent.

Minneapolis & St. Louis.—L. G. Scott has been appointed Auditor, with headquarters at Minneapolis, Minn., succeeding Frank Nay, resigned. (See Chicago, Rock Island & Pacific.)

New York, Susquehanna & Western.—See Erie.

Northern Pacific.—T. H. Crosswell has been appointed Division Engineer, with headquarters at Tacoma, Wash., succeeding G. A. Kyle, resigned.

Oregon Short Line.—See Union Pacific.

Pennsylvania.—E. B. Broadway has been appointed Cashier, succeeding B. F. Crawford, retired; office at Philadelphia.

Pennsylvania Lines.—J. A. McGrew has been appointed Engineer of Maintenance of Way of the Eastern Division of the Pittsburgh, Fort Wayne & Chicago. Frank Rhea succeeds Mr. McGrew as Engineer of Maintenance of Way on the Southwest System, at Logansport, Ind., and Mr. Rhea in turn is succeeded by F. M. Graham as Engineer of Maintenance of Way at Zanesville, Ohio. Mr. Graham was heretofore Assistant Engineer at Fort Wayne.

Pere Marquette.—B. Haskell, Superintendent of Motive Power, with headquarters at Saginaw, Mich., has resigned.

San Diego, Cuyamaca & Eastern.—E. A. Hornbeck has been appointed General Manager, with headquarters at San Diego, Cal., succeeding W. S. Waterman, deceased.

Seaboard Air Line.—A. J. Connely, heretofore Trainmaster, has been appointed Assistant Superintendent of the Fifth Division, with headquarters at Jacksonville, Fla.

Southern Pacific.—C. S. Corrigan has been appointed Resident Engineer, with headquarters at San Antonio, Texas.

Terminal R. R. Association of St. Louis.—J. S. Walsh has been elected Chairman of the Board, and is succeeded as President by W. S. McChesney, Jr., hitherto Vice-President and General Manager. C. A. Vinnedge is Secretary; Julius Walsh, Jr., Assistant Secretary, and F. C. Daab, Cashier.

Union Pacific.—The jurisdiction of F. E. Lewis, Superintendent of Dining Cars of the Oregon Short Line, has been extended over the U. P. Mr. Lewis's office will be at Ogden.

Western Maryland.—F. M. Howell has been appointed General Passenger Agent and W. T. Hunter becomes General Freight Agent, effective April 1.

LOCOMOTIVE BUILDING.

The Buffalo Creek Ry. is having two locomotives repaired at the Rome Locomotive Works.

The Santa Fe Central has ordered two locomotives from the Hicks Locomotive & Car Works, in addition to those previously purchased.

The Cleveland, Cincinnati, Chicago & St. Louis is having eight locomotives built at the Brooks Works of the American Locomotive Co. in addition to the 12 reported in our issue of March 13.

The Canadian Northern has ordered 25 simple 10-wheel locomotives from the Canadian Locomotive Co. of Kingston, Ont., for delivery commencing May next. The locomotives will weigh 133,000 lbs., with 107,000 lbs. on the drivers; and have extension Belpaire boilers, with a working steam pressure of 180 lbs.; 239 National tubes, 2 in. in diameter; Belpaire fire-box; tank capacity, 4,000 gallons of water. The special equipment includes: Westinghouse air-brakes, M. C. B. Washburn automatic couplers, Canadian Locomotive Co.'s and Crosby's safety valves, and Michigan or Detroit sight-feed lubricators.

CAR BUILDING.

The Coahuila & Zacatecas is reported in the market for 10 narrow gage box cars.

The Diamond Match Co. is having 30 freights built by M. H. Treadwell & Co., New York.

The Lake Shore & Michigan Southern is having 250 freights built by the Haskell & Barker Car Co.

The Grand Trunk is having 1,000 freights built at the West Detroit Works of the American Car & Foundry Co.

The Missouri Pacific is having 100 passenger coaches built at the St. Charles Works of the American Car & Foundry Co.

The Kansas City, Mexico & Orient is having 500 freights built at the St. Louis Works of the American Car & Foundry Co.

The Atlas Coke Co. is having 30 freights built at the Allegheny Works of the Pressed Steel Car Co., and 30 at the Cambria Steel Company Works.

The Pere Marquette is having 2,500 freights built at the West Detroit Works of the American Car & Foundry Co., and 500 at the Jeffersonville Works.

The Louisiana & Arkansas, as reported in our issue of March 20, is having 150 flat cars built at the Barney & Smith Works. The cars will weigh 28,000 lbs., with a capacity of 60,000 lbs., and will be 40 ft. long and 9 ft. wide, with frames and underframes of wood. The special equipment includes Westinghouse brakes, Tower couplers, and American continuous draft rigging.

The Delaware, Lackawanna & Western has ordered 10 passenger coaches from Barney & Smith. The cars will be 57 ft. long and 9 ft. 8 in. wide, with wooden frames and underframes. The special equipment includes: High speed Westinghouse brakes, Magnus metal brasses, Edwards curtain fixtures, Pantasote curtain material, Gold direct steam heating system, Pintsch light, Standard steel platforms, Barney & Smith seats and trucks, Gould wide vestibules and Taylor steel tire wheels.

The New York Central & Hudson River, as reported in our issue of March 27, has ordered 1,000 hopper gondola cars from the Pullman Company. The cars will have a capacity of 80,000 lbs., and will be 35 ft. long and 8 ft. 10 in. wide, outside, and 4 ft. 3 in. high, with frames and underframes of wood. The special equipment includes cast steel bolsters, National hollow brake-beams, Lappin brake-shoes, Magnus metal brasses, Gould couplers and malleable iron draft rigging, arch bar trucks, and Railway Steel Spring Company's springs.

The Aurora, Elgin & Chicago has ordered 20 passenger cars from the John Stephenson Co., for March and April delivery. The cars will weigh 74,000 lbs., and measure 48 ft. long, and 8 ft. 8 in. wide, and have metal underframes. The special equipment includes: Peckham Manufacturing Co.'s axles, bolsters and brake-beams; Corning brake-shoes, made by the American Brake-Shoe & Foundry Co.; Christensen straight air-brakes; Van Dorn couplers; Consolidated Car Heating Co.'s electric heating system; Sherwin-Williams Co.'s paint; Peckham M. C. B. standard Aurora special trucks; and steel tired wheels of the Standard Steel Works.

The Vera Cruz & Pacific, as reported in our issue of March 13, has ordered 70 box, 50 stock and 25 coal cars, all of 60,000 lbs. capacity, from the American Car & Foundry Co. The box cars will be 34 ft. long, 8 ft. 6 in. wide, inside, and 14 ft. high over all. The stock cars will be 33 ft. 6 in. long, 8 ft. 6 in. wide, and 14 ft. 5 in. over all. The coal cars will be 33 ft. 9 in. long, 8 ft. 6 in. wide, inside, and 8 ft. 2 in. high over all. The frames and underframes of all cars will be built of wood. Special equipment for all includes O. H. steel axles, Simplex bolsters, National hollow brake-beams, cast-iron brake-shoes, Westinghouse brakes and M. C. B. brasses and journal boxes.

The Mexican Central, as reported in our issue of March 13, has ordered 1,050 cars from the Pullman Co., including 700 box cars of 60,000 lbs. capacity, 200 coal and 100 flat cars of 80,000 lbs. capacity, and 50 stock cars of 60,000 lbs. capacity. The box cars will be 36 ft. 6¾ in. long, over end sills; 9 ft. 1 in. wide, over side sills, and 13 ft. 3 in. high, to top of running board. The coal and flat cars will be 34 ft. long, over end sills; 8 ft. 10 in. wide, over side sills, and 4 ft. 2½ in. high, to top of floors. The stock cars will be 34 ft. long, over end sills; 8 ft. 9 in. wide, over side sills; and 12 ft. 7¾ in. high, to top of running board. All cars to be built of wood, with wooden underframes. The special equipment for all includes: Hammered iron axles, National-Hollow brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, M. C. B. standard brasses, Wagner doors for box cars, Westinghouse friction draft rigging, Soule dust guards, cast-iron journal boxes, Sherwin-Williams Co.'s paint, Mexican Central galvanized iron roofs for box and stock cars, Pittsburg Spring & Steel Co.'s springs, and Mexican Central standard trucks.

BRIDGE BUILDING.

AKRON, OHIO.—The Board of City Commissioners will receive bids until April 11, for a concrete steel arch bridge, 40 ft. span and 50 ft. wide, to be built over Little Cuyahoga River. Estimated cost, $5,000.

ALLENTOWN, PA.—The Council has decided to issue $35,000 bonds for the Allen street viaduct.

ANADARKO, OKLA. T.—According to report, the County Clerk will receive bids until April 16 for a steel bridge 16 ft. wide, of three spans 60 ft. each.

ARENA, N. Y.—The long covered bridge at this place, damaged by high water, may be replaced by an iron structure.

BEAVER CITY, NEB.—T. F. Newton, County Clerk, will receive bids until 2 p.m., April 14, for all bridge work to be done in Furnas County during the ensuing year. Prices are to be made by the lineal foot. Among bridges to be built at once are a 300-ft. bridge over Republican River at Edison; a 360-ft. bridge over Republican River at Cambridge, and repairs on the Republican River bridge at Holbrook.

BRADFORD, PA.—The city will vote June 24 on the question of building a $5,000 iron bridge over the Tunungevant at Mill street.

BUFFALO, N. Y.—Chief Engineer of the Grade Crossing Commission, 436 Ellicott Square, will receive separate bids until 11 a.m., April 4, for the substructure and superstructure for a viaduct over the Lake Shore & Michigan Southern on Perry street.

CRAWFORDSVILLE, IND.—It is announced that the County Auditor will receive bids until April 8 for eight steel bridges, with concrete abutments.

CROOKSTON, MINN.—The City Engineer has pronounced the Jerome addition bridge unsafe and recommended a new steel bridge in its place.

FARIBAULT, MINN.—The Common Council has adopted a resolution ordering a viaduct to be built over the railroad tracks along the line of Division street.

FLINTSTONE, MD.—The County Supervisors will build a small steel bridge.

FLUSHING, N. Y.—Edward A. Byrne, Assistant Engineer, Borough of Queens and Newtown Creek bridges, gives the following particulars of a bridge to be built over Flushing Creek by the New York City Bridge Department: The bridge is to be of steel and concrete steel, 745 ft. long, to cost about $270,000. This includes the cost of a 680-ft. temporary wooden bridge with a 125-ft. steel draw span. Bids will be received by G. Lindenthal, Commissioner of Bridges, but the Board of Estimate and Apportionment has not yet taken any action in regard to an appropriation.

FORT DODGE, IOWA.—About $300,000 will be spent for bridges in Iowa this year. This estimate includes a bridge nearly a mile long which the Chicago Great Western has just completed over Des Moines River at this place.

FORT WILLIAM, ONT.—The bridge over Kaministiqua River at Stanley, Ont., is to be rebuilt. The Commissioner of Public Works for Ontario may be addressed at Toronto.

FREDERICTON, N. B.—The New Brunswick Government asks for bids on April 15 for masonry substructure and approaches of North Branch bridge.

HAGERSTOWN, MD.—An inter-county bridge 87 ft. long will be built, at a cost of about $2,500.

HAMILTON, ONT.—Ratepayers will soon vote on the question of raising $100,000 to build the Wellington street bridge, a new high level reservoir and new roadways.

HARTFORD, CONN.—The Connecticut River Bridge & Highway District will build a granite arch bridge 1,100 ft. long over the Connecticut River, at an estimated cost of $1,940,000. Edwin D. Graves, Chief Engineer, 650 Main street, will receive the bids when the date is set.

HAVERHILL, MASS.—The citizens of this city are taking action for building a new bridge over Merrimac River.

KANKAKEE, ILL.—H. U. Wallace, Chief Engineer of the Illinois Central, writes that as far as he knows the company is not planning to build a bridge this year over Kankakee River, as stated in newspaper reports.

LEWISTOWN, MONT.—F. J. Hazen, County Clerk, will receive bids until 2 p.m., May 4, for bridges to be built by Fergus County as follows: A steel bridge over the Judith River at Philbrook, one 55 ft. span; a single span 50-ft. bridge over the Judith River at Pleasant Valley; a single span 40-ft. steel bridge over Cottonwood Creek, on the Lewistown & Great Falls stage road. These bridges will each have a 16-ft. roadway and steel piers.

LITHIUM, MO.—Thos. J. Killian, County Surveyor and Bridge Commissioner, Perryville, Mo., will receive bids April 25 for a 43 ft. steel bridge over Bois Brule Creek.

MARSHALLTOWN, IOWA.—Plans are being prepared for a viaduct.

NASHVILLE, N. C.—Nash County will build a 100-ft. suspension bridge over Far River. W. E. Jeffreys or S. A. Batchelor will receive bids not later than June 1.

NEW HAVEN, CONN.—A $2,000 draw bridge will be built over East Haven River.

OGDEN, UTAH.—A viaduct will be built over the railroad tracks at the Twenty-fourth street crossing.

ORILLIA, ONT.—A bridge is projected over the Severn River between Simcoe and Ontario Counties. Address the Commissioner of Public Works for Ontario, Toronto.

OSNABRUCK CENTRE, ONT.—H. E. Hodgins, Town Clerk, will receive bids until April 6 for excavating, building bridges and other work in connection with the Dunbar drainage scheme.

PARRY SOUND, ONT.—A steel bridge is to be built over Seguin River.

QUINCY, CAL.—Bids will be received at the office of the County Clerk until 10 a.m., May 4, for a steel bridge over Clear Creek on the Indian Valley road in Plumas District.

SAGINAW, MICH.—The Common Council, according to report, has ordered a new bridge to be built over the Saginew River at Genesee avenue. The bridge will have a 40-ft. roadway, two 8-ft. sidewalks and a lift draw. Bids will be asked as soon as the plans are finished.

ST. PAUL, MINN.—The following appropriations have been made: For repairing bridges, $25,000; for extending Third street bridge, $7,500; for building Mendota arch bridge, $12,000.

SPRINGFIELD, MASS.—Chas. M. Slocum, City Engineer, is preparing plans for raising the South End bridge over Connecticut River. This bridge is 1,349 ft. long and consists of eight spans. Plans are also being made for five short spans of plate girder bridge in connection with the abolition of a grade crossing east of the South End bridge. These short span bridges may be built by the New York, New Haven & Hartford, whose tracks they are to cross.

SPRING VALLEY, WIS.—High water has carried away five railroad bridges between Spring Valley and Elmwood.

SUPERIOR, NEB.—Jas. A. Hedgcock, County Clerk, Nelson, Neb., will receive bids until April 17 for building two spans, 100 and 120 ft., and placing four concrete piers for the combination bridge across Republican River.

TORONTO, ONT.—A steel bridge will be built on the Esplanade, over the railroad tracks, at the foot of Yonge street, by the city, the Grand Trunk and the Canadian Pacific.

ULSTER PARK, N. Y.—Geo. M. Kennoch, Town Clerk, writes that a stock company will probably be organized to build a 500 ft. bridge over Rondout Creek.

WASHINGTON, D. C.—Bids were opened on March 28 at the office of Col. Charles J. Allen, Corps of Engineers, U. S. Army, for the proposed highway bridge across the Potomac River. The appropriation now available for this bridge is $996,000, and it must be completed by Feb. 1, 1905. Six bids were opened, three of which were from the Scherzer Rolling Lift Bridge Company, of Chicago, of $980,000, $985,000 and $990,000 respectively, for bridges of its own rolling lift type. The other three bids were for a bridge in accordance with the specifications, which require a bridge similar in type to the new bridge of the Pennsylvania R. R. nearby, and were: Penn Bridge Co., of Pennsylvania, $1,315,000; Arthur McMullen, of New York, $1,091,210, and Pennsylvania Steel Co., of Philadelphia, $1,109,000.

WEISER, IDAHO.—Thomas E. Kelly, Mayor, writes that the committee has not yet been appointed to receive bids for the new steel bridge over Snake River. This bridge will be 750 ft. long, of three spans, and will cost about $30,000.

WICHITA, KAN.—It is said that the County Clerk will receive bids until April 11, for a 50-ft. steel bridge in Attica Township.

WILKESBARRE, PA.—The City Engineer is making plans for a new bridge between North Wilkesbarre and East End.

WILLOUGHBY, OHIO.—It is said that the County Commissioners will receive bids at Painesville, Ohio, until April 6, for a 175 ft. bridge across Chagrin River about two miles from this place.

WINCHESTER, MASS.—It is reported that a bridge will be built over Aberjona River on Beacon street.

YOUNGSTOWN, OHIO.—The County Commissioners will soon advertise for bids for a bridge over Mosquito Creek.

ZANESVILLE, OHIO.—According to report, the County Commissioners will receive bids until April 20 for three single-span steel bridges.

Other Structures.

DECATUR, ILL.—The Decatur Bridge Co. is said to be planning further extensions to its plant.

FAIR HAVEN, WASH.—The Northern Pacific will build a new union station.

FORT WAYNE, IND.—Press reports state that the Pennsylvania Railroad car shops have been damaged by fire to the amount of $75,000.

GREENVILLE, S. C.—The Southern Ry., it is said, will build a station.

HALETHORPE, MD.—G. L. Potter, General Manager of the Baltimore & Ohio, denies the report that the company has decided to build car shops at this place.

HELENA, MONT.—The Northern Pacific will build a large freight house to take the place of the one recently burned.

MANSFIELD, OHIO.—The Stacey Mfg. Co., makers of bridges, structural iron work, coke crushers, etc., will build a plant at Elmwood Place, near Cincinnati, to consist of a machine shop 139 x 500 ft.; foundry, 90 x 200 ft.; pattern shop, 30 x 50 ft.

MUNCIE, IND.—It is said that the Indiana Bridge Co. is planning extensive improvements to its plant.

PARSONS, KAN.—According to newspaper reports, the Missouri, Kansas & Texas will enlarge its shops at this place.

POCATELLO, IDAHO.—It is said that improvements planned by the Oregon Short Line include car shops and foundry to be built at this place.

PORTLAND, ME.—The Portland Iron & Steel Co. is said to have decided to rebuild its plant, which was destroyed by fire last year.

PORTSMOUTH, OHIO.—The Mitchell Mfg. Co. contemplates building a foundry as an addition to its plant.

ST. BONIFACE, MAN.—D. B. Hanna, Third Vice-President of the Canadian Northern, writes that reports in regard to building shops at St. Boniface and Portage Junction are premature, as nothing definite has been determined.

SAN ANTONIO, TEXAS.—The International & Great Northern, according to report, will spend $100,000 on a passenger station and train sheds.

SAN FRANCISCO, CAL.—J. H. Wallace, Engineer, announces that the plans for the Southern Pacific station at Alameda Mole have been approved by the officers of the road. The building will be in Italian Renaissance style, and, with other improvements, will cost about $175,000.

SYDNEY, N. S.—The Intercolonial Railroad proposes to build a new station.

WEEHAWKEN, N. J.—The contract for the New York Central stack has been awarded to the Alphons Custodis Chimney Construction Co.

WEST NEW YORK, N. J.—H. Fernstrom, Chief Engineer, Grand Central Station, New York city, will receive bids until 3 p.m., April 6, for building a skeleton steel brick and stone power station at the New York Central terminal.

WHEELING, W. VA.—The Baltimore & Ohio is expected to build a new passenger station.

WINNIPEG, MAN.—The Manitoba Iron Works Co. is asking for bids for several buildings in connection with its plant.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ACME, RED RIVER & NORTHERN.—It is reported that this company will build an extension to San Antonio. The road now runs between Acme, on the Fort Worth & Denver City, north to gypsum mines, Texas. T. LaHache, Sherman, Texas, is interested. (See Construction Supplement.)

ARKANSAS VALLEY & WESTERN (ST. LOUIS & SAN FRANCISCO).—An officer writes that the proposed route of this road is from Red Fork, Ind. T., via Keystone, Pawnee, Morrison, Perry, Covington and Enid to Avard, Okla. T., 174 miles. Johnston Bros., St. Elmo, Ill., are in charge of the grading, about three-fourths of which has been completed. McCabe & Steen, Oklahoma City, are the sub-contractors. Track laying was to be begun about the first of April. The character of the work is not difficult, maximum grade 1 per cent., and maximum curvature 4 deg.

ATCHISON, TOPEKA & SANTA FE.—A contract has been let by this company to Langtry & Sons, Navasota, Texas, for straightening and ballasting the road between Somerville and Conroe, 60 miles. Work will be begun shortly.

ATLANTIC COAST LINE.—This company is reported to have let a contract to G. S. Baxter & Co., Jacksonville, for building an extension south from Punta Gorda, Fla., to Fort Myers, 29 miles. Contracts have been sublet to T. L. Marquis and W. D. Hough, Baxter, Fla. Rights of way have been secured and work will be begun at once.

BELLINGHAM BAY & BRITISH COLUMBIA.—Surveys are reported for the extension of this road from Bridgeport, Ore., in a northerly direction up the Columbia River to the Methow River; along that stream through Okanogan County, and the slate district in Whatcom County, to a terminus at the junction of the Canyon and Granite Creeks, a total distance of about 85 miles.

BUFFALO, ROCHESTER & PITTSBURGH.—The contract has been awarded to F. A. Brancato, of Blairsville, Pa., to build an extension between Indiana and Black Lick, Pa., about two miles. The work will be finished in about five months.

CANADIAN PACIFIC.—Contract has been let to Foley Bros. & Larson, St. Paul, Minn., for grading the proposed branch line of this company from Arcola, N. W. T., to Regina. The work, which is light, with maximum grades of 3 per cent., and curves of 2 deg., will be begun immediately. (March 20, p. 220.)

CENTRAL OF GEORGIA.—Work has been resumed on the new yards of this company in South Chattanooga. A number of new tracks will be laid. (See Construction Supplement.)

CHICAGO, BURLINGTON & QUINCY.—Work has been resumed on the cut-off from Tracy, Iowa, a point on the Des Moines-Albia Division, east to Oskaloosa, a point on the Burlington & Western Division, 12 miles. The line will probably be completed about July 1.

CHICAGO, ROCK ISLAND & PACIFIC.—An officer denies that this company is planning an extension from Fort Dodge to Dows, to connect with the Buffalo, Cedar Rapids & Northern Division of this road.

CLEAR LAKE R. R. & ELECTRIC POWER.—This company has been incorporated in California with a capital of $1,000,000. It proposes to build an electric line from Hopland northeast to Lakeport, about 10 miles. The principal office will be at Lakeport, Cal.

COAHUILA & ZACATECAS.—This company will build a branch line from Avalos, Mexico, west to San Pedro de Ocampo, 40 miles, for the purpose of tapping the mining district of the Mazapil Copper Company.

COAL BELT (ILLINOIS).—A charter has been granted this company to build from Golconda, Pope County, Ill., through the Counties of Pope, Hardin, Williamson and Saline. F. S. Peabody, A. W. Underwood, J. D. Adams, J. A. McKeown and J. B. Russell, all of Chicago, are incorporators. The principal office will be at Mason, Ill.

COEUR D'ALENE & SPOKANE (ELECTRIC).—Right of way over the Fort Sherman Military Reservation has been granted this company. The proposed route is from Cœur d'Alene, Idaho, to Spokane, paralleling the Northern Pacific. Wm. Dollar, President of the Exchange National Bank, Cœur d'Alene, is interested. (See Construction Supplement.)

COLORADO, OKLAHOMA & TEXAS.—A charter has been granted this company to build a line from Goodwin, Woodward County, Okla. T., southeast to Denison, Texas, 275 miles. E. E. Colby, Springfield, Mo., is Chief Engineer.

DENVER, NORTHWESTERN & PACIFIC.—Bids are now being asked by this company for the grading of 4½ miles of the line from Avarda to Utah Junction, and contracts will shortly be let. By building this line, the Denver, Northwestern & Pacific can run its trains into Denver over the tracks of the Colorado & Southern, thus obtaining both freight terminal facilities and an entrance into the union depot. The present Denver terminus of this company is at Leyden Junction, where a connection is made with the electric line of the Denver & Northwestern.

DETROIT, TOLEDO & MONROE SHORT LINE.—The Detroit & Toledo Construction Co. has closed a contract with Wm. Sterling & Son for 100,000 ties, to be delivered immediately, for use on the northern extension of the Detroit, Toledo & Monroe Short Line between Monroe and Detroit. Maps have been filed showing the location of the proposed route in Wayne County. The new line will cross the Lake Shore & Michigan Southern, the Pere Marquette and the Detroit Southern. Matthew Slush, Detroit, is President. (See Construction Supplement.)

FORT BRAGG & SOUTHEASTERN.—Articles of incorporation have been filed by this company in California. The proposed route is from Fort Bragg in a southeasterly direction to Healdsburg, Sonoma County, 40 miles. Capital stock, $2,500,000. R. H. Swayne, Miles Standish, G. B. Shaw and Geo. T. Wilcox are incorporators.

FRANKLIN & CLEARFIELD.—The final survey of this new line in Pennsylvania, from Franklin east to Clearfield, 40 miles, has been begun. The object of the road is to connect the Lake Shore & Michigan Southern with

the Beech Creek R. R. Chas. Miller, Franklin, Pa., is President, and the directors include W. H. Newman, of the New York Central; T. J. Jerome, of the Lake Shore & Michigan Southern, and O. D. Bleakly, Franklin, Pa.

GREAT NORTHERN.—It is reported that this company will build an extension from Thief River Falls northeast to Roseau, Minn., 50 miles. This move on the part of the Great Northern is believed to be an effort to forestall any extension of the Canadian Northern in that region.

Work has been begun on both ends of the tunnel which is to be built just outside of Seattle, Wash., in connection with the terminals which this company has planned at that city. The tunnel will be about 1½ miles long. (See Construction Supplement.)

HARBOR BEACH & PORT HOPE.—This company has been incorporated in Michigan to build from Harbor Beach north to Port Hope, Huron County, eight miles. M. J. Carpenter, J. H. Simpson, A. M. Smith and F. W. Stevens, of Harbor Beach, are directors.

ILLINOIS ELECTRIC.—Articles of incorporation have been filed by this company to build an electric line from Galesburg, Ill., west to Monmouth, and north to Aledo and Rock Island, 60 miles. J. S. Brown, Wm. H. Sexton, of Monmouth, Ill., and James E. Gregg, Colorado Springs, Colo., are directors.

LAKE SHORE & MICHIGAN SOUTHERN.—A contract has been let to the Patton & Gibson Co., Pittsburg, for grading and excavating at points between Buffalo and Cleveland for third and fourth main tracks. Work will be begun immediately.

LOS ANGELES, DAGGETT & TONOPAH.—This company has been incorporated in Arizona, with a capital of $7,000,000. The proposed route of the road is from Daggett, Cal., to Tonopah, Nev., running in a north and south direction through the counties of San Bernardino and Inyo in California, and Esmeralda and Nye in Nevada, a total distance of about 200 miles. J. Irving Crowell is President; J. M. Graybill, Vice-President, and W. T. Carter, Secretary and Treasurer, Los Angeles, Cal.

LOUISVILLE & NASHVILLE.—The following work will be done by this company during the ensuing year: A cut-off for a few miles near Nashville, Tenn., for the purpose of reducing grades; extension from Geneva, on the State line between Florida and Georgia, southeast 45 miles, to a connection with the Pensacola & Atlantic Division at Marianna; a spur line to the coal fields from Dale, Ala.; re-laying of 40 miles of track between Talladega and Pyriton; the Knoxville, LaFollette & Jellico extension between Knoxville and Jellico, 45 miles; and the re-laying with heavier rails of 70 miles of line between Marietta and Duckworth.

MANITOBA ROADS.—The Manitoba Legislature at its recent session authorized the incorporations of the following companies: The Midland of Manitoba, to build a number of lines in the province to points on the International boundary; the Portage & Southwestern, to build from Portage la Prairie to Belmont, and to Brandon; the Avondale & Brandon; and the Canadian Northern to build the branches noted in our issue of March 27, p. 240.

MEXICAN CENTRAL.—Surveys are reported in progress for a proposed branch from Mezquite southeast to Lampazos, passing through the Baroteram coal fields, in the State of Coahuila. This line will connect at Lampazos with the San Antonio line of the Mexican Central, which is now being built. Edwin Stalter is the engineer in charge of the surveys.

The tunnel which the Mexican Central and the National R. R. of Mexico are jointly building near the City of Mexico is practically completed. C. Gordon Patterson is the contractor. The tunnel will be 721 ft. long, and will be lined with masonry from end to end. The tunnel will contain a double track to be used in common by both the railroads.

MEXICAN ROADS.—The San Carlos Copper Co. proposes to build a railroad from Linares, a point on the Gulf Division of the Mexican Central, west to San Carlos, in the State of Coahuila, Mexico, 125 miles.

The Penoles Mining Co., of Mapimi, in the State of Durango, Mexico, is considering the project of building a line from Mapimi to connect with coal fields at San Pedro del Gallo.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—An officer writes that the Birchwood extension of this company from Birchwood, Wis., north to Reserve, 20 miles, is under contract to G. M. Huss, Birchwood, Wis. Several contracts for grading and for bridge work will be let in the near future.

MOUNTAIN PARK, TEXAS & NORTHWESTERN.—Charter has been granted this company to build from a point on the Red River, in Comanche County, Okla. T., to the northern boundary of the State, in Woodward County, 200 miles. The capital is $4,000,000 and the incorporators are Oklahoma capitalists.

NASHVILLE, CHATTANOOGA & ST. LOUIS.—A contract has been let to L. R. Wright & Co., Macon, Ga., for building the extension of this road from De Rossett to Eastland, Tenn., seven miles. Some of the work is heavy. The new line will open up valuable tracts of coal, mineral and timber lands and is expected to be completed by Dec. 1, 1903. (See Construction Supplement.)

NORTH BAY & JAMES BAY.—Application is being sought from the Ontario Legislature for an act authorizing the incorporation of this company to build from North Bay, Ont., in a southeasterly direction to Leskeard, and then northeasterly to Iroquois Falls, with a branch from the Mattagani River in a southwesterly direction to a connection with the Canadian Pacific. Curry & Eyre, Toronto, Ont., are interested.

OREGON & PACIFIC.—An officer writes that the proposed route of this road is from Grant's Pass, Ore., southwest via Wilderville, Kirby and Takilma to Crescent City, Cal., 92 miles. Contracts are to be let soon and grading will probably be begun early in June. The work will include five tunnels ranging from 200 ft. to 3,200 ft. long. T. W. M. Draper, Mills Bldg., San Francisco, is Chief Engineer.

PENNSYLVANIA.—A contract has been let to Drake & Stratton for building a 1,300 ft. tunnel east of Williamsburg, Pa., on the Petersburg cut-off. The contract also includes the building of a second track between Hollidaysburg and Huntington.

Bids are now being asked for the grading and excavation work for a second track from Glen Loch, Pa., to Thorndale, seven miles. The work has been divided into six sections, varying from 5,500 ft. to 10,500 ft. in length. Bids will be opened on April 14.

PHILADELPHIA RAPID TRANSIT.—Contract is reported let to E. D. Smith & Co. for building the first section of the Philadelphia Rapid Transit subway. W. S. Twining is Chief Engineer. (See Construction Supplement.)

PORTLAND, VANCOUVER & YAKIMA.—Bids have been asked for building a branch line from a point four miles north of Vancouver, Wash., in an easterly direction for a distance of about five miles.

QUEBEC & LAKE ST. JOHN.—Application is now being made to the Dominion Parliament for the incorporation of a company to build from a point on the Quebec & Lake St. John, near the town of Chicoutimi, in an easterly or northeasterly direction to some point on Rigolet Bay, or Hamilton Inlet, 90 miles, or to some point on the Gulf of St. Lawrence. Caron & Sinclair, Ottawa, Ont., are the solicitors.

RIO SACO.—Surveys are reported completed for this new line in the State of Tabasco, Mexico. The proposed route is from Cardenas, on the Grijalva River, north to Chiltepec, 45 miles. H. L. Ward is in charge of the work.

SANDY CREEK, KINGWOOD & CHEAT RIVER.—This company has been incorporated to build from Cecil, Taylor County, W. Va., northeast to Kingwood, Preston County, 20 miles. The incorporators are Jas. H. Hair, C. S. James, L. R. Lewis, Geo. D. Prentice, Allegheny, Pa., and others.

SCRANTON, FACTORYVILLE & TUNKHANNOCK.—This company, which was recently chartered in Pennsylvania, proposes to build from Scranton northwest to Clark's Green, Waverly, Dalton and Factoryville to Tunkhannock, 25 miles, with branches to Lake Winola and Lake Carey. The capital stock of the company is $500,000.

SEABOARD AIR LINE.—A contract has been let to Dunn & Co., New York, for grading 20 miles of the extension of the Seaboard Air Line from Rockmart, Ga., southeast to Atlanta, a total distance of 40 miles.

SOUTHERN.—It is reported that bids are about to be asked for the building of a branch line from Maryville, Tenn., through the Blue Ridge Mountains to a connection with the main line of the Southern in North Carolina, a distance of about 65 miles.

SOUTHERN PACIFIC.—Surveys are reported completed for the cut-off which this company proposes to build from a point a short distance southeast of Oswego, Ore., northwest to Beaverton, 6½ miles, connecting the Yamhill Division with the West Side Division.

TEXAS & NEW ORLEANS (SOUTHERN PACIFIC).—This company is asking bids for building a branch from Sour Lake to Sour Lake Springs, 8½ miles. E. B. Cushing is the Maintenance of Way Engineer, Houston, Texas. (See Construction Supplement.)

TOLEDO & MICHIGAN ELECTRIC.—Articles of incorporation have been filed by this company to build a line from Adrian, Mich., to Coldwater, 56 miles. The proposed route will parallel the Lake Shore & Michigan Southern. Right of way is now being secured. W. P. Hestor and P. P. Ducket, of Toledo, and R. W. Kirk, of Adrian, are incorporators.

TRANS-CANADA RY.—The Dominion Government has granted this company a charter to build from Quebec to Port Simpson, B. C.

UNION PACIFIC.—Bids are being asked for the 31 miles of reconstruction work from Ogden southwest to Morgan, Utah. Contract for the work from Morgan east to Echo, 15 miles, was let to the Utah Construction Co., a short time ago. (See March 13, p. 204.)

WESTERN MARYLAND.—A recent decision of a jury of condemnation which awarded Burns & Russell $17,000 for less than one acre of ground in Baltimore County, Maryland, has prompted this company to change the route of its extension to tidewater. A new survey has been made which runs along the northeast side of Gwynns Falls near Calverton, to Westport, where the crossing to the south side of Locust Point is made. This new survey will delay the building of the proposed extension for several months.

WEST MICHIGAN INTERURBAN.—The organization of this company has been completed in Michigan. It is proposed to build an electric line from Mill Creek, in a northeasterly direction, passing through the towns of Sparta, Kent City, Casnovia, Muskegon, Whitehall, Montague, Shelby and Hart, a total distance of about 90 miles. The line, when completed, will parallel the Pere Marquette between the two points last named. F. A. Nims, F. J. Russell, C. L. Churchill, W. E. Osmun and others, of Muskegon, Mich., are interested.

WISCONSIN CENTRAL.—This company is planning to build a three-mile spur from Camp Lake south to Wilmot, Kenosha County, Wis.

WYOMING & BLACK HILLS.—Articles of incorporation have been filed by this company to build and operate a line in South Dakota and Wyoming. L. C. Twombly, Cheyenne, Wyo., is interested.

GENERAL RAILROAD NEWS.

ALASKA CENTRAL.—This company is offering for sale $3,500,000 5 per cent. 30-year gold bonds, to be issued in amounts not exceeding $35,000 per mile. The Central Trust Co. of Illinois (Chicago) is trustee. These bonds are to be subject to call at 105 after 1908. The company proposes to build a line from Resurrection Bay, Alaska, via Lake Kenai and Caribou Pass, to Atwood on the Tenana River. G. W. Dickinson, Seattle, Wash., is President and General Manager. (March 27, p. 239.)

BUFFALO & SUSQUEHANNA.—The New York State Railroad Commission has approved the issue by this company of a first mortgage for $6,000,000. The proceeds from these bonds will be used in refunding outstanding indebtedness and in building a new line from Wellsville, N. Y., to Buffalo.

CANADIAN NORTHERN.—The Manitoba Legislature has passed a bill guaranteeing the bonds of this company to the extent of $10,000 per mile on branch lines, aggregating 338 miles, in Manitoba, and $2,000 per mile additional for rolling stock. The present liabilities of the Government for this road aggregate $11,395,000.

COLORADO & WYOMING.—A mortgage of $7,000,000 has been filed by this company with the Mercantile Trust Co., New York. The Colorado & Wyoming belongs to the Colorado Fuel & Iron Co., and it is the intention to use the proceeds of the sale of bonds for building extensions.

FORT WAYNE TRACTION.—This company, the capital of which is $2,000,000, has been sold to a syndicate composed of Geo. F. McCulloch, Indianapolis; H. T. Paul, Fort Wayne, and J. Levering Jones, Philadelphia. It is proposed to merge the road with a number of other urban and interurban electric lines to form a large system.

GREAT NORTHERN CONSOLIDATED SECURITIES CO.—This company is being organized in Ontario, with a capital stock of $8,000,000, for the purpose of holding a majority stock of the Great Northern of Canada, the Montford & Gatineau and the Chateaugay & Northern. It will issue its own stock with the stock of the above roads as a pledge. A controlling interest in the new company will be held by James McNaught and H. H. Melville, of the Great Northern, and Mackenzie & Mann, of the Canadian Northern.

MANHATTAN (ELEVATED).—On April 1 this company passed into the hands of the Interborough Rapid Transit Company, and Mr. E. P. Bryan, General Manager of the latter, becomes General Manager of both. Mr. Bryan says that the wages of gatemen at the stations will be increased.

MEXICAN CENTRAL.—The *Commercial and Financial Chronicle* prints the following detailed statement of the Mexican Central Company's mileage from Jan. 1, 1902:

	Miles.
Mileage on Jan. 1, 1902, operated	2,297.43
On March 1, 1902, there was added to the mileage of the Monterey & Mexican Gulf Div.	388.36
Total mileage from March 1, 1902, to Dec. 31, 1902	2,685.79
On Jan. 1, 1903, the following additions to the mileage were made and operated from that date:	
Mexico, Cuernavaca & Pacific Division	181.25
Rio Verde Branch	26.32
Zamora Extension	11.94
Dynamite Branch	6.21
Sulphur Spur	3.25
Total mileage on which earnings are now reported	2,914.76

MIDLAND PACIFIC.—A mortgage has been filed by this company with the Beacon Trust Co., of Massachusetts, securing the payment of $5,000,000 5 per cent. 20-year gold bonds. The proceeds of the mortgage will be used in building from San Luis Bay to the Sunset oil district in Kern County, Cal. A. Feist, San Francisco, Cal., is Secretary of the company. (See March 6, p. 176.)

OZARK & CHEROKEE CENTRAL.—At a special meeting the stockholders have voted to increase the capital of this road from $2,000,000 to $9,000,000, and to issue bonds, the proceeds of which are to be used for a line from Fayetteville to Ocmulgee; a line 75 miles long from Fayetteville, Ark., in an easterly direction; an extension from Ocmulgee to Oklahoma City by way of Shawnee, and a line from Muskogee to Fort Smith, Ark.

PENNSYLVANIA.—The directors of this company have voted to shareholders of record May 9, the privilege of subscribing to new stock at $60 per $50 share between June 15 and 27, inclusive, to the amount of one-third of their holdings, payments to be made in three instalments as follows: Fifty per cent. at time of subscription; 25 per cent. between Oct. 15 and 26; 25 per cent. between June 15 and 25, 1904.

QUEBEC SOUTHERN.—This road, which has not been in use for several months, as reported in our issue of March 20, will again resume operations. All repairs made necessary by the disuse of the track have been finished, and the officers of the company report that the whole line will be in operation again by the beginning of next week. The road runs from Noyan Junction to Sorel, Que., 89 miles. (March 20, p. 220.)

RALEIGH & CAPE FEAR.—This company has filed a mortgage for $310,000 with the Knickerbocker Trust Co. Under the provisions of the mortgage, 40-year 5 per cent. gold bonds will be issued and the proceeds will be used to extend the road to Lillington, N. C., and thence through Harnett and Cumberland Counties to Fayetteville. The improvements include a bridge across the Cape Fear River near Lillington.

ROSWELL R. R. (SOUTHERN).—This company has filed a mortgage for $175,000 with the Standard Trust Co. of New York as trustee. Bonds are to be issued to that amount bearing 5 per cent. interest and due in 1953. The mortgage covers all the property, franchises and equipment of the road, including the new branch to Bull Sluice Shoals now building. This company was chartered in 1863 and runs from Chamblee, Ga., through DeKalb, Macon and Fulton Counties to Roswell, 10 miles. It is operated as a part of the Southern. A. B. Andrews, Richmond, Va., is President.

ST. LOUIS, SAN FRANCISCO & TEXAS.—The Governor of Texas has approved the law which authorizes this company to purchase and operate the Red River, Texas & Southern, the Paris & Great Northern, the Fort Worth & Rio Grande, the Blackwell, Enid & Texas and the Oklahoma City & Texas Railroads.

SYRACUSE RAPID TRANSIT.—This company has purchased the Syracuse, Lakeside & Baldwinsville, which runs from Syracuse, N. Y., to Baldwinsville, 14 miles. An extension will probably be built from Baldwinsville to Oswego, N. Y., and rights of way have already been secured.

TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS.—The gross earnings of this company for the year ending Dec. 31 were $2,615,360 as against $2,385,809 in 1901, an increase of $230,051. Operating expenses were $1,120,992, an increase of $225,496. Net earnings show an increase of $4,555. It is stated that $5,763,759 will be spent during the ensuing year on the improvements to furnish the facilities necessary for handling the increased traffic at the World's Fair of 1904.

TERRE HAUTE & INDIANAPOLIS.—A legal notice of the sale of this road to satisfy a judgment of $913,905 has been affirmed by the Supreme Court of the State of Indiana. The judgment, together with the costs and 6 per cent. accrued interest, will bring the total liability of this road to the State of Indiana to more than $1,000,000. The company has as yet given no appeal bond, and so there is nothing to prevent the State from securing the judgment.

WABASH.—At the special meeting of the stockholders and debenture bondholders of this company on May 5, a proposition will be voted upon to issue $10,000,000 50-year 5 per cent. gold bonds, the proceeds to be used to buy additional terminal property in St. Louis, Kansas City, Chicago, Quincy, Toledo and Detroit.